Review of Adams Mine Environmental Assessment

February 28, 1997

Ms. Mary Hennessy,
Environmental Assessment Co-ordinator,
Ministry of Environment and Energy,
250 Davisville Ave., 5th Floor,
TORONTO, ON M4S 1H2

Dear Ms. Hennessy,

RE: *ALGONQUIN NATION SECRETARIAT*
REVIEW OF ADAMS MINE ENVIRONMENTAL ASSESSMENT

Enclosed is our submission to your Ministry regarding the Environmental Assessment for the Adams Mine site landfill proposed by Notre Development Corporation. Volume 1 comprises the main report. Volumes 2 and 3 contain supplementary information which you will find of interest.

Please consider our research, results and recommendations in your analysis of Notre's Environmental Assessment. We request notification of the completion of your review and that you also send notification to our consultant, Mr. Brian Gallaugher, Gallaugher Associates, 213-101 Hammersmith Ave., TORONTO, ON M4E 2W3. If you have any questions please do not hesitate to contact us or Mr. Gallaugher at (416) 690-5238, fax (416) 690-6819.

Yours very truly,

Harry St-Denis,
Grand Chief,
Algonquin Nation Secretariat

REVIEW OF ADAMS MINE ENVIRONMENTAL ASSESSMENT

(ENVIRONMENTAL ASSESSMENT SUBMITTED BY NOTRE DEVELOPMENT CORPORATION TO THE ONTARIO MINISTRY OF THE ENVIRONMENT AND ENERGY IN DECEMBER 1996.)

VOLUME 1 of 3 - MAIN REPORT

February 28, 1997

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REVIEW OF ADAMS MINE ENVIRONMENTAL ASSESSMENT

February 28, 1997

EXECUTIVE SUMMARY

The Algonquin Nation is composed of three Algonquin First Nation Communities: Wolf Lake, Timiskaming and Barriere Lake. The Timiskaming First Nation's reserve is situated on Lake Timiskaming near the mouth of the Blanche River, which drains the Adams Mine site. The Algonquin Nation is clearly in the sphere of influence of the proposed Adams Mine site landfill (AMSLF).

We assert aboriginal title to the Adams Mine site. Our preliminary research indicates that the site is part of our traditional land use area. We continue to use the area for fishing and other harvesting.

We are concerned about the impact of this proposed landfill on the waters, wildlife, lands and people of our traditional territory, which we have depended on for survival since time immemorial.

Background

In 1995, Metropolitan Toronto concluded a preliminary investigation of the potential for building and operating an environmentally safe and economically viable municipal solid waste landfill at the Adams Mine site.

At that time, an independent Public Liaison Committee engaged peer reviewers, including Mr. Brian Gallaugher, a Toronto planner, and Dr. G. Fred Lee, a recognized expert in landfill design, to review Metro's work. They found no fatal flaw that would rule out the possibility of developing a landfill at the site which would be protective of public health and the environment. However, there were many significant issues that needed to be resolved and commitments to be made by the developers before a decision could be made on whether this landfill, as proposed, could be developed into a protective facility that would be an economic asset to the area. Further, in December 1995 it was clear that the costs of landfilling at the Adams Mine site, including the provision of true long term protection for public health, ground and surface water resources and the environment, would likely be substantially higher than those projected by Metro's consultants.

Metro abandoned the project due to uncertainties about the feasibility of the project and the availability of other options. Notre Development Corporation, the owner of the site, pursued the project and has now submitted an Environmental Assessment to the Ontario Ministry of the Environment.

In 1997, the Algonquin First Nations hired Mr. Gallaugher and Dr. Lee to review Notre's Environmental Assessment and to assist them in making a presentation to the Ministry of the Environment. The reviewers found that many of the key issues raised in 1995 had not been addressed. It has become clear to the reviewers that Notre's approach for developing the AMSLF is one of minimizing the cost of landfill development, especially in the area of public health and environmental protection, in an effort to try to make the Notre proposed landfill a competitive, economically viable solid waste management facility.

EA Deficiencies

Notre's Environmental Assessment does not properly address many issues, among which are:

- the impact that the proposed landfill may have on aboriginal land use in the area

- the true length of the contaminating lifespan of the landfill (over 1,000 years for some chemicals, according to Notre),

• the ability of the experimental systems designed to protect the environment to outlast the ability of the landfill to pollute,

• the ability of the proposed monitoring systems to detect leakage of leachate, especially in fractured rock, and to detect the presence of hazardous chemicals in surface water,

• the need to go further than Ministry of the Environment minimum standards, especially with regard to potentially hazardous but unregulated chemicals present in leachate and in the water to be pumped out of the pit,

• the accumulation of mercury and other hazardous chemicals in the fish and wildlife of the region which are used as food by our people, in addition to the elevated levels already present,

• impacts of gas emissions, odours, dust and noise and

• the ability of birds to spread disease throughout the region

Also of concern is the economic viability of the landfill and the consequences to the environment and our people if the operator finds the facility does not pay and abandons it. Commitments must be made to set aside a contingency fund, from the beginning of operations, which will allow for remediation of any negative impact caused by the landfill, including the removal of the waste if this is the only way to stop the pollution. The image of our traditional area as a dump for Ontario's wastes is also of concern.

Recommendations

The Minister of the Environment and Energy should reject and return Notre's Environmental Assessment. Many of its conclusions are not reliable and many important issues have not been satisfactorily addressed. If the Minister does accept an improved Environmental Assessment from the proponent at some time in the future, the Minister must order an Environmental Assessment hearing to ensure that the voices of all those within the sphere of influence of the proposed landfill are heard.

We recommend that the Minister seriously consider rejecting the proposal at this stage because of the uncertainties it contains for our traditional lands.

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REVIEW OF ADAMS MINE ENVIRONMENTAL ASSESSMENT

February 28, 1997

THE ALGONQUIN NATION

Introduction

The Algonquin Nation Secretariat (ANS), or Tribal Council, serves as the administrative arm of the Algonquin Nation. It seeks the well-being of its members through social and economic justice. Membership is made up of three Algonquin First Nation Communities: Wolf Lake, Timiskaming and Barriere Lake. The three member communities have a collective population of approximately 2,000.

The Timiskaming Reserve is closest to the Adams Mine of the three communities. It was established in 1851 and comprises approximately 2,400 hectares and 1,241 members. The Reserve is located to the south-east of the Adams Mine site immediately east of the Ontario/Quebec border (see map).

Interest in the Adams Mine Site Landfill Proposal

The ANS asserts aboriginal title to the Adams Mine site and is currently doing land claims research under federal comprehensive claims policy. We have made a preliminary finding that the Adams Mine site is part of our traditional land use area. That research has been based on historical documents as well as oral history from elders of the Timiskaming First Nation who formerly lived (and hunted, fished and trapped) in the vicinity of the Adams Mine site. There is also evidence that the Algonquins of Timiskaming First Nation continue to use the region of Larder Lake, Blanche River and Lake Timiskaming for fishing and other harvesting.

The Algonquin Nation has never taken part in any treaty or land surrender agreement with France, Britain, the federal government, Ontario or Quebec. A 1966 map of Indian Treaties and Surrenders, prepared by the Government of Canada, shows the Adams Mine site as part of certain lands for which there has as yet been "no valid surrender".

The proponent and developer of the Adams Mine project (Notre Development Corporation) has been publicly denying the validity of Algonquin claims - as well as the legitimate participation of the ANS in the comprehensive claims process. It should be

remembered that it is the responsibility of the federal government - not the proponent - to decide whether the Algonquin statement of interest in the Adams Mine site is legitimate.

Since the arrival of English and French speaking peoples into the Algonquin lands over two centuries ago, our people have experienced the flooding of our lakes and rivers, the clear-cutting of our forests and the depletion of fish and game by non-native sports users.

Our traditional way of life has been seriously impacted by these non-native activities and the Algonquin Nation has not benefited from the development of our lands and resources. Notre Development Corporation now proposes to develop a landfill for at least twenty million tonnes of household and industrial garbage to come from all over Ontario, and particularly from the south.

Location of Algonquin Nation Bands

We view this as a public health, environmental and land claims issue. We are genuinely concerned about the potential impacts the Adams Mine site landfill proposal may have on the waters, wildlife, lands and people of our traditional territory. Our concerns are magnified by the fact that the Timiskaming First Nation has a reserve located on the Quebec side of Lake Timiskaming near the mouth of the Blanche River. Issues of polluted surface and groundwater will have serious long term implications for the Algonquin residents of the region.

The Ontario Ministry of Environment and Energy must take our concerns into consideration. The Algonquin First Nation has depended on the forests, lands, waters, and air for survival since time immemorial and continues to rely on our traditional territory. Even without the land claim, the Algonquin First Nation lies within the sphere of influence of the proposed landfill, given our people's traditional reliance on hunting, fishing and trapping and the potential impact of this landfill on fish and other wildlife in the watersheds serving our traditional territory.

Participation in the Adams Mine Site Landfill Process

The Tribal Council made a presentation to Metropolitan Toronto (Metro) Council in November 1995 in response to Metro's plan to landfill its wastes at the Adams Mine site. We alerted Metro to our concerns and asked to be kept informed. In January 1997 ANS received copies of the Environmental Assessment submitted by Notre.

We have engaged consultants who have helped us understand the implications of this proposal. Our consultants have found numerous deficiencies in the proponent's quality of work and their approach to completing the Environmental Assessment. The following sections of this report set out in detail our concerns with the Environmental Assessment documents that Notre has submitted to MOEE. We feel that the Environmental Assessment is sufficiently flawed that it must be returned to Notre for major revision to correct the errors and omissions that we have pointed out before this process can go any further.

Beyond the question of the competency of the Environmental Assessment , however, we have grave concerns about the ability of the proponent to guarantee that our traditional lands and waters, our natural resources and wildlife will not become more polluted than they already are. We question whether the proponent is prepared to take the measures that will be required in monitoring, remediation and financial assurances to ensure that any environmental or public health impact can be handled for as long as the wastes in the proposed landfill remain a threat.

Recommendations and Conclusions

The Algonquin Nation strongly recommends the following course of action to the Ontario Ministry of the Environment and Energy to ensure the traditional rights of our people are preserved and that the public health and interests of all those in the sphere of influence of the proposed landfill are protected.

Reject Notre's Environmental Assessment (EA)

The EA submitted by the proponent should be rejected because it is seriously deficient in many respects. These deficiencies limit the reliability of the conclusions presented in the EA. It should be returned to Notre Development with instructions to re-examine at least the subjects listed below, which have not been properly addressed, as explained in the body of this report. In addition, some relevant information has not yet been included in the EA material distributed for review. A revised and complete EA may then be resubmitted for further review and comment by the MOEE, other interested Ministries and the public, including the First Nations.

Order a Full Environmental Hearing

Once a satisfactory EA has been submitted to the MOEE, the Minister must order a full Environmental Assessment Board hearing. This will allow a discussion of the many contentious issues which surround this experimental landfill proposal and will help provide protection for the rights of the Algonquin First Nation and others.

Consider Immediate Rejection of the Undertaking

The proposed landfill is a significant risk to people, wildlife and the natural environment. The experimental nature of components of the facility, the need for large contingency funds to cover the worst-case scenario and the uncertain financial viability of the project all call into question whether the project should proceed. The Minister should consider rejecting the undertaking at this stage.

Partial List of Deficiencies in Notre EA

Additional work is required by the proponent to address the following:

Aboriginal Land-Use

- investigation of aboriginal land-use activities of the Algonquins of Timiskaming First Nation in the area of the proposed landfill

Potential for Landfill to Pollute the Environment

- the reliability of the modeling used to predict the expected behaviour of potential pollutants in the landfill, i.e. the contaminating lifespan, including the use of a unspecified constituent 100 times more hazardous than the worst of the chemicals considered by Notre in its modeling of the contaminating lifespan,
- the level to which leachate and pit dewatering should be treated beyond minimum MOEE standards, especially with regard to mercury,
- the ability of wetlands to retain pollutants during high flow periods,
- the potential for the existence of toxic constituents in the existing pit water, including chronic toxicity testing on unregulated chemicals,
- a discussion of all biological pathogens which will be present in the waste, such as enteroviruses and cyst-forming protozoans,
- the reliability of the "worst-case" scenario presented.

Monitoring Programs

- the need to monitor the impacts of the wide variety of regulated as well as unregulated hazardous/deleterious chemicals which will be discharged during landfill operations and development,
- the need to control toxic emissions above the minimum standards set by MOEE, based on the most current information available and standards in other jurisdictions, especially with regard to mercury and vinyl chloride,
- the proposed water quality monitoring program, including the need to monitor off-site production wells,
- the reliability of groundwater monitoring programs in fractured rock,
- the need to monitor gas flaring for production of dioxins,
- the need for independent, comprehensive third-party monitoring reporting to a citizens' advisory committee,
- current and future testing for aquatic life toxicity and appropriate reporting of bioaccumulation of hazardous chemicals, especially mercury, chlorinated hydrocarbons and pesticides, selenium, dioxins and PCB's at levels currently known to be hazardous and with sufficient sensitivity to detect them,
- the reliability of the aquatic life ecological risk assessment,
- the need for comprehensive, intensive monitoring of wildlife populations for an increased incidence of cancer or other adverse affects,
- a commitment to carry out all necessary monitoring programs and a discussion of the amount and source of the financial resources needed to ensure effective monitoring until the landfill no longer presents a threat.

Remediation

- definition of possible remediation approaches for potentially polluted groundwater, independent of whether drinking water objectives have or have not been exceeded,
- a prediction of the magnitude of funding that could be required to remediate the worst-case scenario and a discussion of how these funds are to be provided.

Engineered Features

- reliability of the modeling used to predict potential biological and chemical fouling of the drainage layer during the pumping phase and a commitment to operate this system as long as the wastes are a threat to the environment,
- reliability of the proposed gravity drainage groundwater collection system to collect all leachate-polluted groundwater and discharge this groundwater to the surface, including the issue of leachate density,
- reliability of the modeling used to predict the amount of moisture which will enter through the cover of the landfill,
- reliability of the evaluation of the benefits of shredding waste placed in the landfill,
- the need to contain gas, odour, dust and noise impacts on site,
- the approach to be used to determine when excessive birds are present and the measures that will be taken to control them.

Economic Viability

- the economic viability of the undertaking, especially in relation to existing alternatives available for the waste which the proponent expects to receive.

SUMMARY REVIEW OF ADAMS MINE ENVIRONMENTAL ASSESSMENT

(EA submitted by the Proponent to the Ontario Ministry of the Environment, December, 1996)

prepared by

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Presented in this report is an overall assessment of the potential impacts on the public health, groundwater resources, environment and other interests of those within the potential sphere of influence of the proposed Adams Mine site landfill (AMSLF) proposed by the Notre Development Corporation (Notre). For the purpose of this report, these various potential adverse impacts are collectively termed "impacts." A summary of key issues is presented below.

Credentials

Dr. Lee holds a Ph.D., was a university professor teaching graduate level environmental engineering and is a professional engineer in the State of Texas. Since he retired from university teaching and research in 1989 and became a full-time consultant he has been active with many governmental agencies such as water utilities, municipalities and others in helping to evaluate the potential for an existing or proposed landfill to cause pollution of groundwaters. His work has included serving as an advisor to public groups in Ontario, New Brunswick and the City of Winnipeg on landfill siting and development issues.

Brian Gallaugher holds a Bachelor of Arts degree from the University of Toronto and a Bachelor of Environmental Studies degree from the University of Waterloo, Ontario. His consulting practice has focused on landfill siting and operational issues from the perspective of both proponents and residents who may be impacted. Significant projects have included work with groups in Kirkland Lake, Ontario, Saint John, New Brunswick, Sarnia, Ontario and communities surrounding Metropolitan Toronto.

Reviewers' Involvement / Metro Toronto Process

The commentators, Dr. G. Fred Lee and Mr. B. Gallaugher, became involved in the Adams Mine site landfill Phase 1 Environmental Assessment in the summer of 1995 where they were appointed independent peer reviewers to the AMSLF Public Liaison Committee. During the fall of 1995 they conducted extensive reviews of Metro Toronto's (Metro's) consultants' draft reports. Metro's reports evaluated the potential impacts of Metro's proposed development of the Adams Mine site into a landfill that would manage about two million tonnes per year, for 20 years, of Greater Toronto Area (GTA) municipal solid waste (MSW), a total of 40 million tonnes.

Due to the short period between the provision of Metro's consultants' draft reports to the peer reviewers (late November 1995) and the date Metro Council was to make a decision on whether to proceed with Phase 2 of the Environmental Assessment (EA) (mid-December 1995), there was insufficient time for Metro and its consultants to develop completed Phase 1 reports that addressed the peer reviewers' comments. Metro staff issued a series of "interim" reports for the Adams Mine Site Assessment Project, dated December 4, 1995, which failed to address the many significant problems that the peer reviewers found in the draft Phase 1 reports. It was Metro's staff's position that these issues would be addressed in the Phase 2 Environmental Assessment if Metro Council decided to proceed.

Dr. Lee and Mr. Gallaugher reported to Metro Council in December 1995, that, as of that time, no "fatal flaw" issues had surfaced which would rule out the possibility of Metro developing a protective landfill at the Adams Mine site. However, there were significant issues that needed to be resolved in the Phase 2 Environmental Assessment before a definitive decision could be made on whether this landfill, as proposed, could be developed into a protective landfill that would be an economic asset to the area. Further, in December 1995 it was clear that the costs of landfilling at the Adams Mine site associated with providing true long term protection for public health, ground and surface water resources and the environment would likely be substantially higher than those projected by Metro's consultants. This could readily make Metro's use of the AMSLF more costly than alternative approaches for MSW management that were potentially available to Metro. Metro Council determined in mid-December 1995 that Metro would not proceed with the Phase 2 Environmental Assessment for the AMSLF.

Following Metro Council's decision not to proceed with the development of the Adams Mine site as a Metro landfill, Notre, as the owners of the Adams Mine site, announced that it would proceed independent of Metro. Notre at several places in its December 1996 Environmental Assessment documents claims that Metro Council abandoned the AMSLF because it wished to pursue a private waste management approach. This was not the case. Metro is currently investigating all options for

management of its long-term waste management system. For example, Metro held a special solid waste disposal public workshop on February 22, 1997. The workshop was to examine how Metro's waste can best be managed once it leaves the curb and was to focus on disposal (as opposed to diversion) issues only.

The commentators (Dr. Lee and Mr. Gallaugher) have reviewed the various Notre December 1996 EA documents and have found that in many respects they are essentially the same as the draft documents that Metro's consultants submitted to Metro in the fall of 1995 as well as the "Interim Reports" that Metro staff submitted to Metro Council on December 4, 1995. Many of the key issues raised by the peer reviewers have not been addressed in the proponent's December 1996 EA documents. It has become clear to the reviewers that Notre's approach for developing the AMSLF is one of minimizing the cost of landfill development, especially in the area of public health and environmental protection, in an effort to try to make the Notre proposed AMSLF a competitive, economically viable solid waste management approach that would be used for solid waste disposal potentially by Metro and other municipalities and private solid waste generators in Ontario.

Presented herein are comments on many of the significant deficiencies in the Notre December 1996 Environmental Assessment documents. These comments are based on Dr. Lee's and Mr. Gallaugher's many years of experience in evaluating the impacts of landfills at various locations in Canada, US, and other countries. They are also based on an in-depth, critical review of Metro's consultants' draft Environmental Assessment Phase 1 reports and several of the Notre December 1996 EA documents. Particular attention is focused in these comments on the information provided by the proponent in its

Environmental Assessment Overview, Environmental Protection Act Summary, Technical Appendix B Design and Operations - South Pit (1996), and the Technical Appendix B Attachments as well as the Surface Water Quality Addendum G2 (1996). The other Notre December 1996 reports were reviewed to a lesser degree. Also reviewed were the Notes of Meetings of the Adams Mine Peer Review Process Committee (AMPRPC).

Environmental Assessment Requirement for Alternatives

The Environmental Assessment Act requires proponents to examine all alternatives to the undertaking. This is difficult when the proponent is a private corporation as it does not have any practical ability to implement other methods of achieving their objective, i.e. waste disposal. Notre takes this argument further, however, by seeming to imply that because it owns a site that cannot be used for any other purpose, there should be no question of an approval for a landfill. The alternative in this case is the "do-nothing" approach. In other words, the Ministry of Environment

and Energy has a responsibility to determine whether the potential harm to the Ontario environment implicit in this proposal justifies its approval when it is possible that the waste could be handled better in another available facility.

This becomes particularly important given the fact that no information has been presented that indicates what proportion, if any, of the waste available in Southern Ontario will, in fact, be transported to the Adams Mine site. This is a function of transportation costs and tipping fees. The EA contains no discussion of these factors.

Public Participation/Peer Review in AMSLF Assessment

As reported to Metro Council, Metro's public participation process in 1995 did not allow adequate time for peer and public review of many of the key issues that should have been reviewed as part of completing the Phase 1 Environmental Assessment. The process was, however, at least directed by an independent body, the Adams Mine Public Liaison Committee (AMPLC), which was composed of elected representatives of local areas and interest groups.

Notre, in 1996, appears to have conducted a peer review process in which it has controlled the scope and breadth of information provided to the Adams Mine Peer Review Process Committee, a body of three to four citizens selected by the proponent. Unlike the approach used by Metro, Notre has not supported comprehensive peer review managed and directed by an independent third party. In fact, the Adams Mine Peer Review Process Committee Notes of Meetings state that the Notre-appointed peer review firm's (Gartner Lee) role in the peer review process was to be "one of guidance and support" (AMPRPC-Notes of Meeting, July 22, 1996).

Aboriginal Land-Use

The proponent has conducted land-use studies for agricultural and recreational use and has reviewed municipal land-use plans. No mention is made of the aboriginal land-use activities of the Algonquins of Timiskaming First Nation. There is evidence that this Native band uses the region of Larder Lake, the Blanche River and Lake Timiskaming for fishing and other harvesting. In light of the potential land claim situation, the proponent should discuss the issue of how its proposed landfill may affect these specific traditional activities.

This is particularly relevant as Notre plans to use neighbouring land for dilution of airborne and surface and groundwater pollution, as noted below. Native use of this land could be disrupted by odours, harmful gases, dust, litter, noise and polluted surface and groundwaters unless the proponent commits to a program of zero impact off-site. Hunting and fishing could be ended because animals have become diseased due to exposure to pollutants from the landfill.

Potential for Groundwater and Surface Water Pollution by Landfill Leachate

Adequacy of Existing Information. While the proponent did some additional work involving collection of surface water samples during 1996, at this time there are still significant technical deficiencies in the studies that have been conducted on current groundwater and especially surface water quality. These deficiencies significantly limit the reliability that Notre can justifiably claim regarding the ability of the proposed landfill design, operation, closure and post-closure care to prevent off-site pollution of groundwater and possibly surface water by landfill leachate for as long as the wastes in the landfill represent a threat. There is still a lack of information on current aquatic life toxicity and inappropriate presentation of bioaccumulation data for hazardous chemicals in the surface waters of the region.

While the proponent states in its EA documents, *"The site can be safely designed and operated as a landfill facility"*, this is a premature assessment of the safety of the proposed landfill facility based on what is known today. At this time it can be indicated that it may be possible to develop a "safe" landfill facility at the Adams Mine site. However, there are still significant questions about the reliability of the leachate management approaches that Notre proposes to use.

Hydraulic Containment Operations. A hydraulic containment mode of operation involving inward groundwater flow into the landfill where the groundwater and leachate are removed from the bottom of the landfill appears to be feasible. Substantial further work needs to be done to demonstrate the reliability of this mode of operation, however, especially as it relates to the potential plugging of the wastes and drainage layer due to biological fouling.

Gravity Drainage Operations. There are also significant questions about the reliability of the gravity drainage mode of operation (proposed to be activated at the end of the "surface water" contaminating lifespan) in preventing leachate-derived constituents from polluting groundwaters of the region. The primary area of concern is the ability of the

proposed gravity drainage groundwater collection system to collect all leachate polluted groundwater and discharge this groundwater to the surface under controlled conditions. Further, the proponent has not adequately addressed contaminating lifespan with respect to groundwater pollution.

Service Life of Leachate Removal System. There is substantial reason to believe that Notre has over-estimated the service life of key components of the leachate removal system, especially with respect to biological fouling. There is a significant potential for blockage of this system by biological growths and chemical precipitation that could impair the system's ability to maintain an effective hydraulic containment mode of operation and prevent off-site groundwater pollution by leachate.

Contaminating Lifespan. While the proponent estimates that the contaminating lifespan for surface water pollution of the proposed landfill will be on the order of 100 years, there are significant questions about the reliability of this estimate. The modeling approach used by Notre contains a number of highly questionable assumptions about the expected behavior of potential pollutants in the AMSLF regarding their long term potential to be present in leachate well beyond the contaminating lifespan calculated by Notre. It is more likely that the contaminating lifespan of this landfill will be several hundred to a thousand years or more.

If the contaminating lifespan exceeds the expected service life of key components of the leachate removal system, then this landfill may not be granted a Certificate of Approval by the Ontario Ministry of Environment and Energy (MOEE).

Leachate Generation Rates. Notre has underestimated the amount of moisture that will enter the landfill through the cover of the closed landfill. This will result in increased leachate production over that estimated. The ramifications of this increased leachate production have not been adequately evaluated.

Leachate Treatment. The proposed leachate treatment system has the potential to provide high degrees of leachate treatment that, if properly operated and monitored, could protect water quality within the receiving waters; ultimately the Misema River. Notre's incorporation of a constructed wetlands to provide additional treatment of the leachate beyond that of the proposed PACT system will provide some additional protection for the watercourses receiving the leachate treated waters and the Misema River. However, the proponent has failed to properly evaluate and report on the fact that wetland systems can, at times, especially during early spring high flow periods, release appreciable pollutants to downstream watercourses.

Disposal of Pit Dewatering Water. While it appears, at this time, that the water in the Adams Mine site pits can be discharged to surface watercourses, the studies that have been conducted on the characteristics of these waters by the proponent have not reliably evaluated all potential constituents or conditions that need to be evaluated. No chronic toxicity testing was done on these waters to determine if unregulated chemicals within them could be potentially toxic to aquatic life in the watercourses and the Misema River.

It is possible that further studies could show that expensive treatment of the pit waters would have to be carried out before discharge to the environment.

Surface Water Quality Monitoring. A key component of the leachate treatment system will be the development and implementation of a water quality monitoring program that assesses the potential impacts of the residual regulated and unregulated chemical constituents in the treated leachate. At this time, Notre has not proposed an adequate water quality monitoring program to protect aquatic life and other uses of the watercourses into which the treated leachate will enter, including the Misema River, from residual chemical constituents in the treated leachate.

Notre has failed to address an extremely important issue raised by Dr. Lee and Mr. Gallaugher in their 1995 review of Metro consultant's draft reports concerning the potential for the large number of potentially hazardous/deleterious unregulated chemicals in municipal landfill leachate to cause ground and surface water pollution. Notre proposes to monitor a small number of the many thousands of chemical constituents that are present in municipal solid waste leachate. Many of the chemicals in municipal solid waste leachate that are not now monitored nor regulated could be detrimental to public health, groundwater resources, and the environment. A protective landfill leachate management system would develop approaches to address the significant deficiencies between the commonly used monitoring approaches and those that can be implemented to provide for higher levels of groundwater and surface water quality protection.

Bioaccumulation of Mercury/Risk Assessment. Dr. Lee and Mr. Gallaugher, in their comments on Metro's 1995 draft reports, pointed out that inadequate attention had been given to the tendency of mercury in the treated leachate to bioaccumulate in aquatic and terrestrial life to levels hazardous to humans and animals that use this life as food. In response, the proponent incorporated into its December 1996 EA documents a mercury "ecological risk assessment." However, the approach used in conducting this risk assessment relied on an out-of-date assessment of the significance of mercury as a health hazard that does not reflect the current understanding of the impacts of mercury on human and animal life.

Groundwater Quality Monitoring. The wastes in this landfill will contain a wide variety of hazardous, infectious, conventional and non-conventional pollutants, including human and animal fecal matter from disposable diapers and pathogens such as enteroviruses and cyst-forming protozoans. Small amounts of leachate contaminated by these pollutants will have the potential to cause large amounts of groundwater pollution. This reinforces the need to locate the landfill in an area that offers a high degree of assurance that leachate will not enter the ground and surface waters.

The groundwater quality monitoring program developed thus far by the proponent is deficient compared to the program that will ultimately be needed to detect pollution of groundwaters by leachate that could escape from the hydraulic containment system proposed by Notre, especially given the location of the proposed landfill in fractured rock. Notre should be required to develop a groundwater monitoring approach that will

ensure a known high degree of reliability in detecting leachate-polluted groundwaters under the Adams Mine site property before these groundwaters migrate under adjacent properties.

Groundwater Production Well Monitoring. The operator should be required to conduct groundwater monitoring of all wells producing water for domestic or agricultural use (production wells) within the potential worst-case sphere of influence of leachate polluted groundwaters that could develop at the AMSLF for as long as the polluted groundwaters and landfill represent a threat. For planning purposes, this period of time should be considered to be infinite. This off-site production well monitoring should be conducted to detect incipient groundwater pollution by landfill leachate with a sufficient early warning so that pollution of any well is known before harm to the users of the water occurs.

Third-Party Monitoring. The operator should fund a comprehensive third-party independent monitoring program for landfill operations and environmental impacts in order to detect problem areas before they become significant. This third-party monitoring should be conducted in such a way as to supplement the operator's and the regulatory agencies' monitoring programs. The results of this monitoring program should be presented directly to a citizens' advisory committee responsible for the oversight of the AMSLF's development, operations, closure and post-closure care.

Worst Case Scenario Evaluation. The worst case scenario for pollution of groundwater by landfill leachate predicts that appreciable local surface water pollution could occur in the vicinity of the landfill. Insufficient information is available at this time to be certain that this proposed worst case scenario has been, in fact, reliably developed. There may be other conditions that need to be incorporated into a worst case scenario evaluation.

Remediation of Polluted Groundwaters. At this time, the proponent has given inadequate attention to defining possible remediation approaches that could be used for groundwater pollution that might develop as a result of the AMSLF. A key part of the development of a "safe" landfill is the development of remediation approaches to the maximum extent possible for polluted groundwaters that might, under worst-case conditions, develop at the landfill and be transported off-site to pollute adjacent property owners' groundwater supplies.

Funding of Remediation. A key part of development of the groundwater pollution remediation program will be a prediction of the magnitude of the funding that could be needed for program implementation and how the operator can assure that the funds will, in fact, be available in perpetuity. These contingency needs could potentially include removal of the wastes from the AMSLF (landfill mining) if it is not possible to stop off-site pollution of groundwaters from this landfill by any other method.

Reasonable Use Policy. It is important in planning for a "protective" landfill to not utilize the MOEE Reasonable Use Policy approach, as Notre proposes, which allows the contamination of groundwaters by leachate up to 25% and 50% of the Ontario Drinking

Water Objective for health and non-health related parameters, respectively. This Policy fails to consider the presence of hazardous, unregulated chemical constituents in landfill leachate that could be transported through aquifers off-site. In addition, regulatory standards are constantly being revised as research is conducted into the toxicity and carcinogenicity of chemicals which are found in MSW leachate.

Any contamination of off-site groundwater by leachate (any presence of a leachate-derived constituent) should, for public health and groundwater resource protection, be considered a situation that requires groundwater remediation independent of whether any drinking water objectives are exceeded. This is prudent public health policy and a commitment to which the Adams Mine site community and property owners-users of land near the landfill should be entitled.

Adequacy of MOEE Landfilling Regulations. The current MOEE landfilling regulations are deficient in several areas to ensure the protection of public health and the environment from adverse impacts of landfill derived constituents. In addition to the deficiencies associated with the reasonable use policy and some of the water quality objectives, one of the most important deficiencies is the failure of these regulations to require adequate bufferlands between the waste deposition areas and adjacent properties. The operator will likely have to purchase or gain easements from adjacent properties in order to dissipate adverse impacts of the proposed landfill associated with odour, dust and noise.

Waste Shredding/Controlled Addition of Moisture. Notre has concluded that shredding of the waste to enhance the hydraulic characteristics of the landfill and thereby reduce its contaminating lifespan is not justified. It appears, however, that an inappropriate analysis of this situation has been made. Notre should reevaluate the potential benefits of shredding the waste placed in the landfill and the controlled addition of moisture to the landfill to enhance the rate of waste stabilization. This is accomplished through conversion of many of the organics into landfill gas and the leaching of the waste to remove leachable components in a shorter period of time than will occur under the proposed mode of operation.

Other Impacts

Landfill Gas. There is a significant potential for on-site landfill gas problems associated with vinyl chloride emissions and groundwater pollution by volatile organic compounds (VOCs). These problems could be manifested off-site. Further, of particular concern is the potential for vinyl chloride to cause cancer in wildlife inhabiting the area near the proposed landfill. Comprehensive and intensive sampling of wildlife populations will be required to monitor this situation.

The potential for production of dioxins, one of the most hazardous chemicals known to man, during the flaring of landfill gas is also of concern. This issue has not been addressed by Notre.

Odour. Notre projects that there will be significant off-site odours from this landfill. It is not clear, however, that the projections have reliably estimated the full magnitude of these odours. Notre's approach of asserting that the odour problems will not be adverse to existing nearby residences fails to recognize that adjacent public and private owners/users of property should be entitled to such use without landfill odours at the property line. Adjacent properties cannot be used to dilute odours due to the operator's inadequate management practices. While the proponent asserts that odour is only a nuisance, it is well known that highly offensive odours such as those associated with landfills can be detrimental to individual health. Notre will need to develop odour control approaches and/or acquire additional property for odour dissipation so that excessive odours do not occur at adjacent property lines.

Dust. Notre predicts that there will be potentially significant dust releases off-site, arising from landfill operations. At this time, inadequate attention has been given to the potential human health hazards associated with PM_{10} and $PM_{2.5}$ particles in this dust. The operator must be required to operate this landfill such that there is no increase in dust on adjacent properties at the property line or along roadways leading to the landfill from existing conditions.

Noise. Notre discusses the potential for adverse impacts of landfill-derived noise and some other adverse impacts of emissions from the landfill at nearby property residences. It is the reviewers' understanding that the operator will have to control adverse impacts at the landfill property line. Adjacent properties should not be used to dissipate the adverse impacts of releases from the landfill.

Birds. The original evaluation of possible bird problems by Metro consultants was highly superficial and in some instances inaccurate. Without highly effective bird control programs, gulls and other birds could possibly become a problem at the proposed landfill through impacts on aviation and possibly through the transport of disease. Notre, in its revised evaluation of bird hazards, now admits that there could be problems due to the landfill attracting birds. While the proponent claims that it will monitor for these problems and take action if they occur, Notre has not provided sufficient information to enable an evaluation of the approach that it would use to determine when excessive birds are present in the vicinity of the landfill and the action that will be taken to control them.

On-Site 3R Activities. At this time the on-site 3R activities, if any, have not been defined. Of particular concern is the potential for outdoor composting and the control of odors associated with such composting activities.

Economic Evaluation. The economic evaluations performed by the proponent do not provide sufficient details to enable peer reviewers to evaluate the adequacy and reliability of the projected costs of landfilling at the proposed AMSLF. Of particular concern is the potential that the true cost of operation and especially post-closure care will be substantially higher than those projected. It is possible that these costs may add ten to several tens of dollars per tonne to the disposal costs associated with the development and use of the proposed AMSLF. Further, the potential for developing a landfill gas recovery

system may significantly overestimate the revenue that will in fact be generated by the recovery and use of landfill gas.

There is a significantly different situation between Metro's proposed development of this landfill and a private for-profit operation. If unexpected costs arise Metro would be able to pass these on to GTA residents as part of their garbage collection and disposal fees or even from general revenue or contingency funds. A private operator will not have the ability to increase the cost of disposal fees without loss of part, possibly a substantial part, of the waste stream upon which it is dependent to make this a successful business venture. There is appropriate concern that the operator could start the landfilling of wastes and then find that the problems of developing and operating the landfill are much greater than anticipated, requiring significant additional funding to provide a protective landfill. The operator could decide that it no longer wishes to continue to run the landfill and leave area residents with a significant liability. From the information available it does not appear that, if an operator decides to terminate activities, sufficient funds derived from operations will be available to address all potential problems, including the removal of wastes from the landfill.

Overall Assessment

Overall, at this time the proponent has not provided reliable and/or adequate information on the impacts of the proposed AMSLF on off-site public health, groundwater resources and the interests of those within the potential sphere of influence of the landfill.

While at this time Notre states that the AMSLF will be developed so that it is "protective" and a "good neighbor" to the owners and users of the lands near the landfill, there is need for additional Environmental Assessment work to be done to address a number of the unanswered questions that still remain. Further the operator should provide dedicated funds in a trust fund to address contingencies that could readily occur if this landfill is to be developed with a high degree of certainty of full protection of public health, groundwater and the environment.

It is likely that addressing what are now known and what could develop as potentially adverse impacts of Notre's proposed AMSLF could significantly increase the cost of landfilling at this site from that currently projected by the proponent.

DETAILED REVIEW OF ADAMS MINE ENVIRONMENTAL ASSESSMENT

Reviewers' Involvement / Metro Toronto Process

In 1995, Metro Toronto (Metro) conducted a initial review of the potential public health and environmental problems associated with the development of the closed Adams Mine site iron ore pit located near Kirkland Lake, Ontario as a landfill that would be able to accept approximately 2 million tonnes per year, for 20 years, of Metro's municipal solid waste (MSW). This "Phase 1" review involved the development, by a number of Metro

consultants, of reports on various issues pertinent to the landfill project. Metro, in accord with its policy of full public review, provided financial support to a Public Liaison Committee (PLC) composed of individuals elected to represent various municipalities and organizations in the area. The PLC appointed an independent Ontario consulting firm (Gartner Lee) as the Ontario based "peer reviewer" of Metro's consultants' Phase 1 draft reports. Metro also provided support to the PLC to enable the PLC to receive independent third party peer review of Metro's consultants' draft reports by Dr. G. Fred Lee and Mr. Brian Gallaugher.

As discussed herein, Dr. Lee and Mr. Gallaugher have extensive experience and expertise in evaluating the potential of landfills to cause detrimental environmental and other impacts. Dr. Lee has been active in this discipline for over 30 years in the US, Canada, and other countries. In addition to serving as a consultant to water utilities, municipalities, and others on the potential impacts of a proposed or existing landfill, Dr. Lee held university graduate level teaching and research positions in environmental engineering for a period of 30 years, during which time he was active in conducting research on a variety of aspects of municipal solid waste management and public health protection.

In Dr. Lee's original review of Metro's Phase 1 review of the public health and environmental impact of the proposed project, he found that, based on Metro's review, the proposed project could continue, i.e. there was nothing found in the Phase I review that would cause him to conclude that a landfill could not be developed at the Adams Mine site that would be protective of public health, the environment, and the interest of those potentially impacted by the landfill. As stated in the materials that Mr. Gallaugher and Dr. Lee submitted to Metro Council in December 1995, this conclusion about the feasibility of developing a landfill at the Adams Mine site was based on continuation of Phase 1 into the then Metro proposed Phase 2 Environmental Assessment review. Also, in their opinion, while it would have been possible, based on the information available, for Metro to develop a landfill at the Adams Mine site that would be protective of public health, the environment, and the interest of those within the sphere of influence of the landfill, the cost of developing such a landfill would likely be higher than the cost that Metro's consultants had estimated.

Metro Council concluded in December 1995 that, because of the large numbers of uncertainties that arose out of the Phase 1 review and the potential for a significantly higher cost for MSW management than other available alternatives, Metro would abandon its attempt to develop the Adams Mine site into a landfill and not proceed with Phase 2 of the Environmental Assessment. Notre, in its December 1996 Environmental Assessment documents, repeatedly claims that the reason that Metro did not proceed with the Phase 2 Environmental Assessment was that Metro wanted to pursue private sector operators for Metro's solid waste management. The facts are that the uncertainty of being able to develop the Adams Mine site into a "protective" landfill coupled with anticipated higher costs were the reasons for Metro not proceeding with Phase 2 of Environmental Assessment.

Reports Reviewed

Metro Council had established a date in mid-December 1995 by which it would make a decision on whether to proceed with Phase 2 of the Environmental Assessment process. Many of Metro's consultants did not complete their Phase 1 draft reports by the agreed to date. Consequently there was inadequate time for the peer reviewers to review the draft reports and submit their review to the PLC, Metro and its consultants so that Metro and its consultants could address the questions raised by the peer reviewers and the PLC. However, Dr. Lee and B. Gallaugher did provide extensive comments on the significant deficiencies that occurred in Metro's consultants' draft reports. These are summarized in Volume 3 of this report.

On December 4, 1995, Metro issued "Interim Reports for Submission to Council" for the purpose of providing Council with some of the information that evolved from the Phase 1 review. These reports were basically the draft reports developed by Metro's consultants, essentially without addressing the issues raised by Gartner Lee, Dr. Lee and Mr. Gallaugher. A review of these interim reports shows that the proponent, in its December 1996 Environmental Assessment documents, has, in a number of instances, placed a new date and cover page on the draft documents that Metro's consultants submitted to Metro and the peer reviewers in the fall of 1995. This fact is noted by Notre in a covering letter explaining the necessary changes in wording (proponency, application for South Pit only, etc.).

The comments presented in this report are based primarily on review of the proponent's December 1996 Adams Mine Environmental Assessment documents. The comments focus on review of the

Environmental Assessment Overview,

Environmental Protection Act Summary,

Technical Appendix B- *Design and Operations-South Pit* and Attachments,

Addendum G2 to Technical Appendix G- *Surface Water Quality*,

Addenda H1 and H2 to Technical Appendix H- *Aquatic Biology* and *Terrestrial Biology* and to a lesser extent

Addendum A1 to Technical Appendix A- *Public and Agency Consultation*,

Addendum C1 to Technical Appendix C- *Bird Hazard and Health*

Addenda F1-F7 to Technical Appendix F - *Geology/ Hydrogeology* and

Appendix K- *Economics*.

Subsequent to Metro's abandonment of the AMSLF, the proponent decided to continue to develop this landfill. It released comments on Dr. Lee and B. Gallaugher's review of the Phase 1 Metro Environmental Assessment submitted to Metro Council in December 1995. A response to these comments in included below.

Peer Review

Notre's current "peer review" is markedly different in approach and quality to the approach conducted by Metro. While Metro supported a full publicly managed and directed, independent peer review of issues, the proponent has practiced a limited, proponent-directed process, based on a review of the committee's meeting notes. The Notre-appointed Adams Mine Peer Review Process Committee was not supplied with adequate information on issues that should be considered by a properly constituted public peer review committee. Even the role of Gartner Lee, as the peer reviewer, is

acknowledged in the committee's notes to be supportive of the project, not necessarily part of an independent peer review. (Item 7 of Notre's Adams Mine Peer Review Process Committee Notes of Meeting of July 22, 1996 states that, *"Gartner Lee will carry out an arms length role, one of guidance and support.")*

It is important to acknowledge that while the independent peer review approach, as practiced in Ontario, has considerable merit, it is not necessarily a true independent peer review of issues that the public, i.e. those potentially impacted by a proposed landfill project, should be entitled to. Full public peer review requires a knowledgeable, independent team who are directed and paid by an independent body not associated with the proponent. Potential conflicts-of-interest need to be considered and evaluated in the engaging of consultants for peer review, as well.

The following sections follow the structure of the six reports reviewed, as presented by the proponent. All comments are referenced to their corresponding pages in the Notre document and are presented in order. As the Environmental Assessment Document is also a summary of the Notre's separate appendixes, there is some repetition, which is reflective of the repetition in the EA.

Environmental Assessment Overview (December 1996)

(Note: Most of the material presented in the Environmental Assessment Overview is repeated in the Environmental Protection Act Summary. To avoid repetition in this report, the reader should apply the comments below to both documents. Page and Table references apply to the Notre Environmental Assessment Overview only.)

The purpose of these documents is to provide an overview of the Environmental Assessment and Environmental Protection Act activities that have been conducted by the proponent to support the development of a municipal solid waste landfill in the Adams Mine pit known as the South Pit.

Page S-2 in the second paragraph states, with regard to Metro's 1995 Phase 1 environmental review, *"The studies confirmed the technical and environmental suitability of the site as a landfill facility."* That statement is incorrect. The Metro 1995 review confirmed only that there were significant questions as to whether the Adams Mine site is a suitable site and that the Environmental Assessment would have to be conducted at least through Phase 2 before it could be concluded that the Adams Mine site was suitable for a landfill of the type proposed.

Alternatives to the Undertaking

The whole discussion of the application of the Environmental Assessment Act's requirement for a review of "alternatives to the undertaking" in this EA seems contrived. It is recognized that private sector proponents have limited or no practical ability to offer alternatives to the undertaking. They do, however, have the one comparative option discussed in the Overview: the "do-nothing" option. Notre seems to infer that because it purchased a property with the intention of developing it as a landfill and that landfilling is the only practical use for the site, approval should be given. Otherwise Notre would not realize a profit on its investment, which is not presented as a viable option.

An approach more in keeping with the spirit of the Environmental Assessment Act would investigate the effects on the environment of 1) Notre's proposal and 2) alternative methods of handling potential MSW being offered by other operators, in other words, not developing a landfill at the Adams Mine site. Purchase by a proponent of a potential site with no other use than a landfill should not mean, as Notre implies, that it should be approved simply because of the fact that if it isn't approved, Notre will lose its investment. There is no question that the "do-nothing" approach would pose less risk to the environment in the Adams Mine Area than the development of the proposed landfill. Compelling reasons should be presented why the potential harm to the environment discussed in this report should be considered for approval when there is no necessity to do anything.

Economic Viability

The proponent has also marshaled information which purports to show the amount of waste generated for disposal in Ontario and particularly the Greater Toronto Area which is potentially available to fill the Adams Mine. As businesspeople, Notre will be aware that the amount of waste that will arrive at the gate is dependent not on the amount available, but on the tipping fee, including transportation, that is charged. The proponent notes that millions of tonnes of IC&I waste are currently going to landfill in the US, even though Metro Toronto offers local disposal at $50.00 per tonne. Private proponents have no ability to compel use of their facility regardless of the cost, unlike public authorities. If Notre's tipping fee exceeds prices offered by local and distant waste handlers in the very competitive GTA market, very little waste will come its way. Notre has provided no information on its proposed tipping fee.

This possibility raises questions of the project's economic viability and the operator's consequent ability to protect the environment discussed elsewhere in this review. The economics of the construction and operation of this landfill should be thoroughly discussed before approval is contemplated. Uncertainty over the economics of the facility was one of the major factors in Metro's abandonment of the project.

Safe Operation

It is stated under Findings of Net Effects Analysis *"1. The site can be safely designed and operated as a landfill facility."* (p. S-5) Contrary to that statement, insufficient work and commitments have been made by the proponent to support the statement that the South Pit of the Adams Mine site can be developed into a protective landfill. Significant questions remain about the commitment of the operator to provide the type of long term public health, environmental and resource protection that is necessary to develop a landfill at this site.

The bulleted items under item 1 on page S-5 are in some cases inaccurate or unreliable. For example, *"...100 years following closure of the site, leachate contaminants will have decreased to levels so that pumping and water treatment activities can cease..."* The 100 years value sited is based on an inappropriate assessment of the contaminating lifespan of the landfill. In fact, as discussed herein, even Notre's consultants project that the leachate from this landfill will still have the potential to contaminate the environment 2000 years after the landfill is closed.

On page S-6, the first bulleted item on the page states that numerous mitigation measures have been incorporated. Notre has left out several key mitigation measures discussed in Dr. Lee and Mr. Gallaugher's comments on Metro's Phase 1 documents such as a commitment to monitor all groundwater production wells within the sphere of influence of the landfill for as long as the wastes in the landfill represent a threat. This approach for monitoring is necessary since conventional monitoring in the fractured rock system underlying the proposed landfill is impossible to do reliably. Further, the proponent has not committed to remediation of polluted groundwaters.

Ecological risk assessment for mercury is mentioned on the bottom of page S-6 and top of S-7. As documented herein, the approach that was used by the proponent in their ecological risk assessment for mercury employs impact levels much higher than those accepted by the US EPA for potential human health impacts from mercury that is bioaccumulated in fish. Notre and its consultants have made frequent use of US EPA developed information on the hazards of chemicals in the environment in their December 1996 Environmental Assessment documents. For mercury, however, the proponent has chosen to use the Ontario value rather than the lower, more protective US EPA value for assessing the hazards of mercury in fish tissue.

The public consultation activities that were conducted by Notre are discussed on page S-8. These public consultation activities were restricted. Also on the same page a summary of findings states that the proponent has conducted the studies in *"...sufficient detail to*

indicate that the site can be safely designed and operated as a landfill facility." This same statement is made on page 1-2 and page 2-3 as well. This statement is incorrect.

Landfill Design and Operation

Page 6-5 states that, *"The service life of the groundwater/leachate management layer is conservatively estimated to be 200 years."* As discussed herein, the approach used by the proponent in estimating the service life of key components of the leachate management system is not reliable. It could readily be that the service life of these components, such as the drainage blanket that allows leachate to leave the landfill, is less than the contaminating lifespan of the proposed landfill. Since some of the key components of the leachate management system cannot be inspected and maintained, it is likely that a proper review of these issues would show that this landfill cannot be approved under MOEE regulations, which require facility systems to have a service life longer than the landfill's contaminating lifespan.

A discussion of landfill gas flaring appears on the top of page 6-10. No mention is made of the potential for dioxin formation that was reported to Metro's consultants and Metro Council by Dr. Lee as part of the review of the Phase 1 documents. Dioxins are of great concern because they are some of the most hazardous chemicals known to man. In 1995 Dr. Lee reported that work by Eden in the UK, as reported in 1993, has shown that landfill gas flares tend to produce dioxins. Dr. Lee pointed out that Metro's consultants should mention this issue in their discussion of landfill gas management and that Metro should commit to evaluating whether the flaring of landfill gas was producing dioxins which were emitted to the atmosphere. Notre, in its December 1996 documents, has failed to mention this issue and has failed to commit to monitoring for dioxins at the landfill gas flares.

Potential Effects on the Environment

Net Effects Analysis

The statement is made that

"...in December 1995 Metro Toronto decided that it would not proceed with the development of the site by the municipality itself, and opted to have the private sector supply landfill capacity for the next twenty years." (page 7-1, second paragraph)

That statement does not properly discuss the issues. As discussed herein, one of the primary issues that influenced Metro's decision was the identification of potential problems with the Adams Mine site and the potential significant increase in cost associated with landfilling at this site compared to landfill capacity and other waste management alternatives that were available to Metro. As pointed out in Dr. Lee and B. Gallaugher's discussion of issues, the Adams Mine site landfill could be potentially developed into a "protective" landfill, however the costs would likely be much higher than those projected by Metro's consultants. Therefore, since private sector landfill space

appeared to be available to Metro at a lower cost, Metro opted to follow that approach for the time being.

The proponent appears to be trying to make the case that Metro did not abandon the site because of its concerns but because it suddenly wished to turn over provision of landfill capacity to the private sector and that Metro may well still be interested in the Adams Mine site, run by a private operator. Notre has presented no evidence that Metro is interested in this site. Metro is currently involved in an exercise to examine all it's long-term options for solid waste disposal, both public and private

The proponent states, *"Notre Development Corporation (Notre) has utilized information form the environmental assessment process started by Metro Toronto (Metro)."* (page 7-1 third paragraph) That statement is true only to some extent. There are a number of key issues raised by the peer reviewers for the Metro-sponsored PLC which are part of the Metro EA process. Notre has chosen not to address or incorporate them into its examination of the public health and environmental protection aspects of this proposed landfill.

Health and Nuisance Net Effects

A statement on Health and Nuisance Net Effects and the accompanying Figure 7.1 on page 7-2 shows that these effects extend beyond the property line for the proposed landfill. Such an approach is inappropriate and contrary to the Ontario regulations. According to Dr. Lee's discussions with MOEE staff, a landfill owner is required to contain all adverse impacts to the landfill owner's property. According to the proponent's consultant's report, there are predicted adverse impacts due to the noise, air quality, dust, litter, odor and landfill gas projected outside of the boundaries of the proposed landfill.

Table 7.1 on page 7-5 summarizes a number of the key issues of concern with respect to off-site impacts of landfill derived releases. For example, under dust it is stated that there is *"Potential for disruption off-site."* It then states that the *"Concentrations at the three closest residences are predicted to be negligible."*This will only remain true if no one constructs a residence closer than the three closest residences present at this time anytime in the future while this landfill can be a source of dust. Such an approach is inappropriate. The same situation applies to the second item on dust. One problem not mentioned at this point although discussed to some extent in other documents is the human health aspects of the dust PM_{10} or the $PM_{2.5}$ particles issue.

Similarly, vinyl chloride is predicted to be present in concentrations off-site in Table 7.1. However, the proponent asserts that it will be safe at off-site residences. Again, the vinyl chloride concentrations at the property line should be safe for adjacent property owners. For public lands, the public should be able to use adjacent properties without fear of acquiring cancer due to exposure of vinyl chloride.

An issue regarding the potential impacts of vinyl chloride that are projected to be adverse to human health at the landfill property line that has not been discussed by Notre is that

wildlife on the landfill property as well as adjacent properties will be exposed to an increased risk of cancer. Vinyl chloride is not only a human carcinogen but is also a carcinogen for animals.

If this landfill is developed as proposed, the operator should be required to monitor the wildlife populations near the landfill for an increased incidence of cancer to be certain that the landfill releases are not adverse to the health of the wildlife in the region. Such a monitoring program will require comprehensive, intensive sampling over long periods of time in order to detect a potential increase in cancer rate among wildlife. While the proponent may claim that such a monitoring program is too expensive, the other alternative is for the operator to manage the release of carcinogens through proper waste management practices. These are costs that should be borne by the landfill developer and those who deposit wastes in the landfill through their tipping fees. Certainly the people and wildlife in the area should not be exposed to an increased cancer risk so that those who deposit wastes in the AMSLF can do so at cheaper than real cost.

In Dr. Lee's discussion in his 1995 comments to Metro, he suggested that Metro should either limit the releases of vinyl chloride, dust, odor, etc. as required by MOEE regulations to the existing landfill property or acquire additional land so that the releases would be diluted sufficiently at the property line.

Table 7.1 on page 7-7 under Natural Environment (the first bulleted item) states that *"No off-site effects on groundwater are predicted"* due to the inward gradient. However, the inward gradient mode of operation is proposed for a relatively short term compared to the time that this landfill will be a threat. Under the heading *"Ability to monitor groundwater and implement contingencies"*Notre addressed the hydraulic/water table elevation issues but not the groundwater quality issues. It is not possible to reliably monitor groundwaters for groundwater quality impacts because of the fractured rock geology of the region.

On this same page under *"Potential for disrupting groundwater supplies and resources"* Notre states that, *"There are no wells in use within 5 km of the site, no existing permitted high capacity wells near the site."* Again, the proponent is only discussing the situation that exists now and is asserting, perhaps incorrectly, that today's situation will be the situation in the future.

In Table 7.1 on page 7-9, with respect to surface water quality from pit dewatering, the proponent has listed potential impacts due to boron, copper, cadmium, phosphorus, and silver. Notre has failed to discuss, however, the fact that there could readily be toxic constituents in the pit waters which have not yet been properly assessed. Notre chose not to accept the recommendations Dr. Lee made in the review of Phase 1 documents to perform appropriate toxicity tests on the pit waters to be certain that they do not contain toxic constituents.

Table 7.1 *"Potential impacts of treated discharge to surface water quality,"* (page 7-9) focuses on the mercury issue. The mercury risk assessment approach does not adequately consider the levels of mercury that are known to be of significance today compared to the

values that were selected for assessing the hazard by the proponent. It should also be noted that Notre has rejected the recommendation that Dr. Lee made in the Phase 1 review that environmental assessment studies be conducted for aquatic life toxicity. Further, the landfill operational monitoring program proposed by Notre

does not include this type of monitoring. These are significant deficiencies in the environmental assessment and proposed approach for operation and monitoring of this landfill. The present EA should be rejected unless proper monitoring for toxicity and bioaccumulation is proposed.

Notre's approach for monitoring the treated leachate from both the treatment works and the constructed wetlands will not be protective of aquatic or terrestrial resources of the region. Rather than relying on composite samples and acute toxicity measurements as the proponent proposes, the monitoring should include detailed individual samples to ensure that treatment plant and constructed wetland upset/releases do not result in adverse conditions occurring in the receiving waters. Further, the proponent proposes to meet MOEE regulatory limits only. A number of these limits are out-of-date and do not reflect current understanding of the impacts of the chemicals involved on public health and the environment. The leachate should be treated to meet water quality protection standards which reflect the latest in reliable technical information on the impacts of chemicals on public health, aquatic life and wildlife.

Under Economics *"Potential for impacts to local economy"* (page 7-13, Table 7.1) the proponent claims that there would be a positive effect anticipated. That is not necessarily true. While there will be some income generated, the area could become known as the garbage dumping ground for Ontario. This could be significantly detrimental to the region for tourism and potentially for the sale of agricultural crops from the area.

Under Human Health Risk (page 7-31 top of the page) it is stated that a mercury guideline for tissue concentration of 0.5 g/g was used. This value is about five times higher than that allowed for consumption of fish by humans who eat one meal a week under US EPA guidelines.

Natural Environment Net Effects

With reference to the discharge of the pit dewatering waters it is stated *"These measures will ensure that there is minimal effect on Misema River water quality"*. (page 7-48 end of the first paragraph) As discussed herein, inadequate investigation has been conducted on the potential for toxic constituents to be present in the pit waters. No discharge can be allowed until proper characterization of aquatic life toxicity and bioaccumulation of hazardous chemicals has been done.

Conclusion of Net Effects Analysis

The Conclusions of the Net Effects Analysis are presented on page 7-64.

"Overall, net effects on the environment are predicted to be low and will be less than predicted if the South Pit only is developed at a rate of 1 million tonnes per year for 20 years."

That statement does not accurately reflect the real situation that will occur if this landfill is developed. The proponent has ignored key issues of environmental protection and has failed to provide support to ensure that the off-site trespass of hazardous and obnoxious chemical releases from the landfill are properly monitored and controlled.

Further and most importantly, the cost of developing and operating this landfill will almost certainly be higher than the cost that Metro/GTA can in the future expect to pay for municipal solid waste disposal. This makes the 1 million tonnes per year waste stream that Notre predicts highly questionable. The net result is that the operator will likely have to cut back on environmental protection, in order to try to remain competitive with other waste management options available to Metro/GTA. This situation raises serious questions about Notre's ability to develop the Adams Mine site as a public health and environmentally protective landfill.

Rather than the landfill being an economic asset to the region as claimed on page 7-64, the proposed landfill could readily be a highly significant detriment to the region. The short term economic gains that some of the communities in the region might realize from the fee paid by the operator for "hosting" the landfill will likely be overshadowed by massive long term liabilities that the people of the region will have to bear.

On page 7-64 the proponent states,

"Geology/Hydrogeology investigations have confirmed the natural protection capabilities provided by the bedrock surrounding the site and verified that groundwater levels are conducive to the hydraulic containment design."

This statement may only be true provided that there is a commitment and adequate funding set aside in a dedicated trust to operate and maintain the inward hydraulic gradient to the South Pit for as long as the wastes represent a threat, Notre does not propose to make this commitment. Instead, Notre is proposing to stop pumping the contaminated leachate after about 100 years and allow this leachate to drain by gravity to the surface watercourses of the region.

The analysis conducted by the proponent on the contaminating lifespan of this landfill has significant fundamental flaws which could result in the service life of key leachate control components being less than the contaminating lifespan of the wastes in the landfill. This could readily result in significant groundwater pollution in the vicinity of the landfill. This situation coupled with the fact that it is impossible to reliably monitor polluted groundwaters in the region because of the fractured rock geology and the apparent lack of commitment by the proponent to provide a dedicated trust fund of sufficient magnitude to ensure, in perpetuity, that all off-site domestic, industrial, and agricultural production wells within the sphere of influence of the landfill are monitored

for incipient groundwater pollution by landfill leachate, should cause the regulatory agencies to fail to approve this landfill as proposed.

While Notre claims that it is prepared to address contingencies of groundwater leachate management system failure, the proponent fails to address one of the key contingencies raised in the 1995 review: that of developing a dedicated trust fund of sufficient magnitude to remediate any contaminated groundwaters that occur off-site. Instead Notre is proposing to pollute these groundwaters with regulated and unregulated hazardous/deleterious chemicals in accord with the MOEE "Reasonable Use Policy." This policy ignores the fact that there are large numbers of unregulated chemicals in municipal landfill leachate that could readily be as, if not more, hazardous than today's regulated chemicals.

An overly optimistic assessment of the water quality impacts associated with the discharge of treated leachate is presented on page 7-65 in the first paragraph. As documented in these comments, just meeting current Provincial surface water quality protection limits and policies does not lead to environmental protection. Some of the regulatory limits are out-of-date compared to what is known in the field today about the potential hazards of chemicals to public health and the environment. In addition, there are significant problems with the pre-operational studies that have been done by the proponent with respect to existing conditions associated with the discharge of the South Pit waters to the watercourses of the region and the existing conditions within the waterbodies of the area. Of particular concern is the lack of information on aquatic life toxicity and inappropriate presentation of data on bioaccumulation of hazardous chemicals within aquatic life relevant to the current knowledge in the area.

By far the most significant deficiency with the proponent's proposed approach for the discharge of the landfill development and operation wastewaters is the failure of the operator to properly monitor the impacts of the wide variety of regulated as well as unregulated hazardous/deleterious chemicals that will be present in the discharge.

Notre's Environmental Impact Analysis is flawed from the prospective of protecting the interests of those within the sphere of influence of the landfill since the proponent proposes to use their property for dissipation of gaseous/airborne and liquid

releases from the landfill. Rather than accepting Notre's approach of allowing hazardous chemical, odorous, and other releases from the landfill to trespass on adjacent properties, the operator should be required to control all releases from the landfill that are in any way detrimental to adjacent and nearby property owners and users at the property line. Individuals owning/using adjacent property should have the right in perpetuity to utilize their properties at the property line without adverse impact by the operator's landfill.

Design and Operations - South Pit (Technical Appendix B 1996)

According to the proponent, Technical Appendix B - Design and Operations, *"...describes the detailed conceptual design of the South Pit, in accordance with Ontario*

Environmental Protection Act Requirements." The 1996 Technical Appendix B is designed to update and replace the 1995 Technical Appendix B that was developed by Golder for Metro Toronto. Dr. Lee provided detailed comments on the highly significant technical deficiencies in Metro/Golder's Technical Appendix B. Copies of those comments are in the record of the AMPLC. Many of them have direct applicability to Notre's 1996 Technical Appendix B. As discussed herein, the proponent in developing its 1996 Technical Appendix B failed to adequately address many of the key issues raised by Dr. Lee in his 1995 review of Metro's proposed design and operation for the Adams Mine site landfill.

Page B.S-2 states,

"The results of the 1996 Design and Operations work and associated assessments demonstrate that the South Pit at the Adams Mine site is environmentally acceptable for the safe landfilling of solid waste."

Further, it is stated,

"This capacity of 20 million tonnes over 20 years is the basis for this design and operations plan to meet the requirements for EPA approval and confirm the economic viability of the site."

These statements are inaccurate. Basically, Notre/Golder has provided inadequate and in some instances unreliable information on the adequacy of the design, operation, and closure of the proposed Adams Mine site landfill. The Notre/Golder Technical Appendix B ignores key issues that must be addressed in a credible environmental assessment of the proposed landfill. Detailed information on many of the deficiencies of Technical Appendix B is provided in these comments.

Waste Quantities and Characteristics

Waste Quantities

Section 2.1 - Waste Quantities (page B.2-1), states that a reduced rate of waste deposition would reduce the impacts of the landfill and extend them over longer periods of time. That statement is not necessarily true. It is our understanding that one of the reasons why Metro Toronto abandoned the Adams Mine site was the potential that a reduced rate of landfilling due to reduced waste availability coupled with the higher cost of landfilling at the Adams Mine site compared to other alternatives would make the

project uneconomical. As private operators such as the proponent would now be responsible for the proposed landfill, there should be concern that the waste volumes available for the landfill may be insufficient to allow the facility to compete with other solid waste management options available. This situation could result in a period of time where the operator would be attempting to cut environmental protection corners in order to reduce its costs in an effort to compete with alternative, less expensive methods of

waste disposal and ultimately abandon the landfill. A credible environmental assessment would have included a discussion on page B.2-1 of these issues pointing out that reducing the waste stream available for the landfill could readily cause this landfill to be uneconomical and unable to operate.

Waste Characteristics

Under Waste Characteristics (page B.2-2), the consultants fail to provide full disclosure on the characteristics of the wastes that are proposed to be deposited at this landfill. The wastes in this landfill will contain a wide variety of hazardous, infectious, conventional, and non-conventional pollutants that will generate a leachate small amounts of which will have the potential to cause large amounts of groundwater pollution. The pollution potential of municipal solid waste leachates have been discussed in a review by Jones-Lee and Lee (1993).

Pre-Processing of Waste

Under the section *Speed Up Decomposition/Reduced Contaminating Lifespan* (page B.2-7), the statement is again made by the proponent, as was made in Metro's 1995 Technical Appendix B, that the shredding of the wastes is not needed to destroy the integrity of the plastic bags used by the public for curbside collection. As discussed in Dr. Lee's previous comments, there is no question about the fact that the plastic bags in municipal solid waste, even after compaction by *"state of the art compaction equipment"*, will significantly interfere with the ability of the moisture that enters the landfill to interact with the solid wastes. Therefore the models that Golder/Notre are using to predict the contaminating lifespan of the proposed Adams Mine site landfill will be inaccurate. While shredding would cost the operator more money and, therefore, reduce the economic viability of this proposed project, it would, if carried out, enable a more reliable prediction of contaminating lifespan than is now being projected.

Overall, the Conclusion on page B.2-8,

"There is no clear evidence that shredding would reduce the contaminating lifespan at this site and due to the associated impacts and additional costs it is not recommended."

is not based on a proper evaluation of the issues.

The section on Biological Treatment (page B.2-16), provides unreliable information on the potential benefits for appropriately conducted biological treatment of the wastes prior to landfilling. There is no question that appropriately conducted biological treatment would significantly reduce the potential for the proposed Adams Mine site landfill to pollute the groundwaters and the environment. Both this and the shredding section place the operator's economic considerations ahead of environmental and public health protection.

Site Design

Design Overview

Page B.3-4, last paragraph, describes the characteristics of the drainage layer that is proposed for use between the bottom of the wastes and the Adams Mine site pit walls. It basically consists of coarsely crushed rock overlain at some locations by a filter layer of more finely crushed rock. As discussed herein, this drainage layer is subject to clogging where leachate may not be able to freely pass from the wastes into the drainage layer through the filter layer. This issue is discussed further in a subsequent section of these comments.

Beginning on page B.3-5 through B.3-8 is a discussion of a "Survey of Existing Landfills". One of the landfills that was surveyed was the Puente Hills landfill in Southern California. As Dr. Lee discussed in his previous comments on this same section developed by Golder for Metro Toronto, the statement included in Table B.3.2 that there is no leachate generated in the Puente Hills landfill due to the "dry climate" is in error. In his previous comments, Dr. Lee provided the Public Liaison Committee (PLC) with quoted sections from a state of California Water Resources Control Board document that demonstrated that the Los Angeles County Sanitation Districts' statement to Golder that the Puente Hills landfill did not produce leachate due to "dry climate" was in error.

It is disturbing to find that Notre/Golder would continue to provide information shown to be factually incorrect to MOEE and the public. This situation calls into question the credibility of the whole EA.

The facts are that the state of California Water Resources Control Board has found, contrary to the statements made by the landfill owner, that the Puente Hills landfill is, in fact, polluting groundwaters by landfill leachate. Notre/Golder should have reported this. Detailed information on this issue was provided to Golder as part of the 1995 review of Technical Appendix B.

Leachate Management System

Leachate Management Objectives and Concept

Under Leachate Management Objectives, the consultants present the MOEE Reasonable Use Policy where it states,

"Quality cannot be degraded by an amount in excess of 50% of the difference between background and the quality criteria for any designated Reasonable Use except in the case of drinking water. In the case of drinking water, the quality must not be degraded by an amount in excess of 50% of the difference between background and the Ontario Drinking Water Objectives for non-health related parameters and in excess of 25% of the difference between background and the Ontario Drinking Water Objectives for health related parameters. Background is considered to be the quality of the groundwater prior to any man-made contamination." (page B.6-1)

Further, on page B.6-2 it states,

"Leachate will therefore be fully contained/collected by the groundwater/leachate management system and groundwater impacts at the property boundary will be within the limits required by Guideline D-7."

Guideline D-7 is the MOEE Reasonable Use Policy.

In Dr. Lee's previous comments on Metro's draft 1995 Technical Appendix B, he provided a detailed discussion as to why the Reasonable Use Policy may not be protective of groundwater resources and public health. These comments focused on the fact that allowing the degradation of groundwaters under adjacent properties to 25% or 50% of the difference between background and the drinking water objectives could readily allow for highly hazardous yet unregulated or unmeasured constituents in municipal solid waste leachate to be detrimental to the health of those who use groundwaters under adjacent properties. As discussed, new hazardous chemicals are continually discovered in municipal solid waste leachates. These hazardous chemicals have been present in the leachate for many years but they were not measured in previous studies. The facts are that only one hundred to a few hundred chemicals are examined in any municipal landfill groundwater pollution study out of the many thousands of chemicals that are present in the leachate that could be detrimental to groundwater and surface water quality. This means that it is extremely important to site landfills where there are high degrees of assurance that leachate will not enter ground and surface waters without extraordinary degrees of treatment. Further, the monitoring program should have the ability to detect the presence of any leachate in polluted groundwaters before widespread pollution occurs. These conditions are not fulfilled in the proponent's proposed approach for developing the Adams Mine site landfill.

The US takes a markedly different approach toward protecting groundwaters from pollution by landfill leachate than MOEE in its Reasonable Use Policy. The US landfilling regulations require that there can be no statistically significant increase in the concentrations of a variety of constituents normally found in leachate at the point of compliance for groundwater monitoring, i.e. no pollution of groundwater by leachate. This point of compliance can be no more than 150 meters from the edge of the waste management unit. In California, the point of compliance for groundwater monitoring/protection is the down groundwater gradient edge of the waste management unit, i.e. the edge of the waste fill area.

The MOEE Reasonable Use Policy is out-of-date with respect to recognizing the potential importance of the unregulated, unmeasured constituents in solid waste leachate. It does permit proponents to develop landfills that will ultimately pollute the groundwaters under adjacent properties, impairing their use with a wide variety of constituents that are detrimental to the property owner.

As Dr. Lee discussed in his 1995 comments on Metro's consultants' draft reports, a landfill proponent that is interested in providing full protection of public health and the

environment would not follow the approach that Notre is following of proposing to pollute groundwaters with landfill leachate-derived constituents in accord with the MOEE Reasonable Use Policy. Instead the proponent would protect the groundwaters from any statistical increase in constituents derived from wastes for as long as the wastes in the landfill represent a threat.

The proponent states that it will protect the environment from leachate-derived constituents in surface waters and,

"Provincial Water Quality Objectives (PWQO) as they relate to surface water quality impacts were considered in the evaluation of the site performance. Measures are included in the landfill design to limit off-site surface water impacts such that they are within PWQO limits during both the landfilling and post-closure period." (page B.6-2)

As discussed in Dr. Lee's 1995 comments on this issue and in his comments on the Notre 1996 Addendum G2 Surface Water Quality, the PWQO limits that the proponent plans to meet with regard to surface water impacts of its leachate discharges are, for some constituents, not protective of aquatic and other life, including humans. Environment Canada has released a number of reports (Canadian Environmental Protection Act, Priority Substances List Assessment Report, 1995) which show that the PWQO limits are out-of-date and are not protective. To fully protect public health and

the environment, Notre would establish discharge limits for leachate reflective of the latest information available on the potential hazards that chemical constituents present in leachate represent to public health and the environment.

Lag in Standards

It is well known that regulatory standards often lag by many years, to sometimes many decades, behind current knowledge on environmental impacts. The Ontario Provincial Auditor, in his *1996 Annual Report*, comments on this fact:

Standard setting is a dynamic process which requires continuous scientific research as new chemicals are constantly being developed by industries. In addition, standards for many contaminants may have to be changed as new data on their toxicity or carcinogenicity become available. (p. 116)

The Auditor goes on to report the results of a MOEE review of standards for contaminants released to the air, undertaken in 1992. The results of the review indicated that only 21% of the 289 standards did not need revision. 3% were still current, the other 18% could not be adequately set because adequate scientific information was not available for revision. 32% of the chemical standards in effect required substantial reduction and/or reassessment. However, the Auditor found that by 1996 " *none of the 226 standards needing review and/or reassessment had been updated, including those 91 [32%] which were identified as 'requiring substantial reduction and/or reassessment.'"* (page 116)

On page B.6-3 in the second full paragraph and throughout all of the proponent's 1996 Environmental Assessment documents, reference is made to a hundred year pumping phase after landfill closure during which leachate that develops in the landfill will be pumped to the surface and treated before discharged to surface water systems that ultimately enter the Misema River. As discussed in Dr. Lee's 1995 comments on the technical basis for developing the hundred year pumping phase estimate, the approach used by Golder in developing this value is not technically valid. That value could easily be well beyond the expected service life of the facility components that cannot be inspected and repaired.

This is an important issue since, as cited on the bottom of page B.6-2 and the top of page B.6-3, according to MOEE guideline C-13, the service life of the containment structure for a landfill must exceed the contaminating lifespan of the landfill. As discussed in Dr. Lee's 1995 comments and herein, there is a high probability that the service life of the leachate removal system components that are essential to leachate control during the pumping phase is less than the contaminating lifespan of this landfill. The net result will be that leachate will build up within the landfill, since it will not, under Notre's approach, be pumped from the landfill. This can lead to groundwater pollution.

Because of the high degree of uncertainty about the ability of the leachate removal approach proposed by Notre's consultants to function as proposed for as long as the wastes represent a threat, Dr. Lee proposed that the MOEE require the proponent to construct a back-up leachate removal system where a pipe is extended through the wastes to the bottom of the wastes that would enable leachate pumping from within the landfill. This approach is being used at a number of US landfills in an attempt to try to stop leachate pollution of groundwaters by removing the leachate within the wastes by pumping. There are commercial firms which develop systems for this purpose. This approach was rejected by the proponent for technical and potentially economic reasons.

The general approach for the proposed landfill operation after the pumping phase has been completed is discussed on page B.6-3. The leachate that is generated in the landfill will be allowed to flow by gravity out of the landfill into a "perimeter collection system." However, as discussed in Dr. Lee's 1995 comments and herein, there is substantial reason to believe that the perimeter collection system will not be effective in collecting all leachate-polluted groundwaters that build up in the landfill after the hydraulic containment mode of operation (after 100 years) is terminated. Notre/Golder repeatedly, in Technical Appendix B and elsewhere in the proponent's EA documents, assert that there is no question about the ability of the proposed mode of operation of the landfill to protect groundwater resources. The facts are that there are substantial questions about the reliability of Notre/Golder's approach.

If this landfill is approved, the operator should be required to establish a dedicated trust fund of sufficient magnitude to ensure that at any time in the future an in-landfill leachate removal system can and will be constructed and operated to remove leachate if the current plan for leachate removal does not function as predicted. Further, the operator must be required to establish a leachate level monitoring system within the landfill wastes

that would detect the build-up of leachate in the wastes arising from the plugging of the filtering layer between the bottom of the wastes and the drainage layer. If such plugging is found, the operator should be required to activate and maintain the pumping and treatment of the leachate for as long as the leachate pumped from inside the landfill is a threat to public health and the environment. This approach is justified based on the highly experimental nature of the proponent's proposed approach for leachate management. If this experiment fails, the people in the area are entitled to far more protection than Notre is currently planning to provide. The permitting of this landfill should have built into it the safeguards that Dr. Lee proposed as part of his review of the Metro 1995 consultants' reports for the development of the proposed Adams Mine site landfill.

To underscore the point, the Provincial Auditor has listed some recent groundwater contamination incidents in his 1996 Annual Report.

In Smithville [Ont.], the remediation program for cleaning up PCB polluted groundwater has taken more than 10 years and cost about $25 million since the discovery of the pollution in 1985. Complete remediation is not currently possible because the technology necessary for cleaning up the bedrock has yet to be developed.

and

In December 1991 in Manotick [Ont.], 74 wells serving over 200 homes and businesses were found to contain a dry cleaning solvent that had leaked from a storage tank at a dry cleaning store. According to the [MOEE], there is little likelihood of cleaning up the groundwater in the near future. In the meantime, an alternate water supply was established at a cost of over $5 million. (p. 124)

Leachate Characterization

A list of 16 critical contaminants appears on page B.6-5. As discussed in Dr. Lee's previous comments on the 1995 Metro consultants' reports, to assume, as the proponent is now doing, that no constituents will be found in municipal solid waste leachate over the next 100 or so years which would have greater pollution potential than the 16 contaminants listed is, at best, naive. There certainly will be chemicals found in municipal leachate that will be at least as hazardous, if not significantly more hazardous, than the 16 contaminants Notre/Golder has chosen to select for its modeling effort. In his previous comments, Dr. Lee provided guidance on how a proper environmental assessment relative to this issue should be conducted, where those doing the modeling should assume that a constituent 100 times more hazardous than the worst of the 16 will, at some time in the future, during the contaminating lifespan of this landfill, be found in municipal solid waste leachate. This situation should then be modeled to evaluate the potential for failure of this landfill system to protect public health and the environment. Notre/Golder have chosen to ignore Dr. Lee's recommendations and have proceeded to present unreliable/inadequate information on the potential impacts of proposed Adams Mine site landfill.

Final Cover Design

The characteristics of the final cover for Notre's proposed landfill are discussed on pages B.6-5 and B.6-6. Basically, this is a soil cover. Notre/Golder state on page B.6-6,

"On-going repair and maintenance of the final cover will ensure that it continues to function as designed."

Those familiar with landfill cover maintenance issues know this statement is not reliable. It is virtually impossible, except at great expense, to maintain a landfill cover "as designed" for as long as the wastes in the landfill represent a threat. These issues have been discussed in detail in the materials Dr. Lee provided in his 1995 comments. As proposed by the proponent, this cover will not provide a controlled rate of addition of moisture to the landfill which will facilitate the fermentation and leaching of the wastes necessary to achieve the projected contaminating lifespan of the landfill.

In his previous comments, Dr. Lee has discussed an approach that would enable controlled addition of moisture to the landfill to ensure that all parts of the landfill receive an appropriate supply of moisture for fermentation and leaching. The suggested approach involved the use of a header plumbing system through which moisture could be added below the cover. It is clear that the proponent, has rejected the controlled moisture approach and, instead, is using an uncontrolled moisture approach that can adversely impact the projected contaminating lifespan of the landfill.

Leachate Volumes

The use of the HELP model to predict leachate generation rates is mentioned on page B.6-7. As Dr. Lee discussed in his 1995 comments on this section in which the HELP model can predict moisture generation and, therefore, leachate generation rates for a new landfill cover, it has limited reliability in predicting leachate generation rates for an aged landfill cover. As Dr. Lee discussed in his 1995 comments, unreliable predictions that have been made in predicting the leachate generation rates have a number of important implications. The amount of moisture in contact with the waste influences not only the leachate generation rate but also landfill gas formation rates, etc. The fact that Notre/Golder did not address the issues Dr. Lee raised in his 1995 comments on the deficiencies in the approach used is of concern. The environmental assessment should have evaluated the potential significance of the error of assuming that the HELP model predictions of leachate generation are applicable throughout the lifetime of the landfill. Without such an evaluation, the Environmental Assessment document should be considered inaccurate and inadequate and returned to Notre for further work to address this and other issues.

Leachate System Management Design

How the constructed wetlands effluent would meet PWQO limits is discussed on page B.6-16. As discussed in the comments on the proponent's Addendum G2 Surface Water

Quality 1996, the approach used by Notre/SENES in making predictions for the characteristics of the wetlands effluent ignored hydrologic factors where, at times, a wetlands effluent is of poorer quality than the influent. While wetlands can be effective in removing constituents during active growing periods, they release constituents at a high rate during non-growing periods, especially during high flows. Even though this issue was pointed out previously in Dr. Lee's 1995 comments, Notre/SENES have chosen to ignore it in connection with their estimating the effluent characteristics for the constructed wetlands that is designed to treat the leachate. This is a significant deficiency in the proponent's Environmental Assessment documents.

The consultants assume that the field capacity of the waste has to be exceeded before leachate generation occurs (page B.6-17). As Dr. Lee discussed in 1995, that statement is incorrect. Groundwater pollution can occur without ever exceeding the field capacity of the waste due to unsaturated leachate transport.

The contaminating lifespan for groundwater impacts due to chloride is estimated to be about 1,000 years (page B.6-17). Notre/Golder states chloride, *"... is an aesthetic parameter and a component of common road salt (CaCl)."* Notre/Golder, however, did not discuss, as they should have, that there could readily be a substantial number of other constituents in municipal solid waste that can be detrimental to public health and/or the environment. The fact that chloride has a contaminating lifespan of 1,000 years is of great concern since it means there could readily be a substantial number of other constituents that could have similar contaminating lifespans. Therefore, this landfill cannot be approved as proposed and still conform to MOEE guideline C-13 that require landfills to have a contaminating lifespan less than the service life of key components for leachate management.

The 180 year service life for the groundwater/leachate management system is based on clogging of the drainage layer by calcium carbonate precipitation (page B.6-19). As discussed in Dr. Lee's 1995 comments, the approach that has been used by Golder to estimate clogging rates is, at best, naive. It ignores the biological fouling that is also an area of primary concern with respect to municipal solid waste leachate clogging of drainage systems. While calcium carbonate precipitation is an important cause of clogging, it is not the only cause. This is one of the most significant deficiencies in the proponent's 1996 Environmental Assessment.

Leachate Treatment and Disposal

Page B.6-22 contains Table B.6.7.1 which gives the drainage layer contaminant loading information. A review of the modeling approach used to develop these estimates shows it has little expected reliability. The projected loads could be in significant error.

Page B.6-29, third paragraph, states,

"While it can be expected that individual measurements may exceed the reported effluent quality values from time-to-time, mean monthly levels are expected to be equal to or less than the anticipated effluent levels."

As Dr. Lee has discussed in his comments on the Surface Water Quality 1995 draft and the proponent's 1996 Addendum G2, aquatic organisms do not respond to the average monthly concentrations of constituents. They are impacted by the "concentration-duration of exposure" relationship. Since critical "concentration-duration of exposure" relationships cannot be estimated from mean monthly concentrations, the approach that has been used by Notre is technically invalid for assessing biological impacts of the treated leachate.

Another factor to consider in review of the discussion of the projected characteristics of the treated leachate is that a number of the PWQOs do not reflect what is known about the critical concentrations of the chemical constituents today. All of these issues should have been discussed in the proponent's Environmental Assessment documents. They were discussed in Dr. Lee's comments on the original drafts which served as a basis for Notre's 1996 EA documents.

The sludge produced from the leachate treatment will be placed in the landfill (page B.6-35). In commenting on the 1995 draft, Dr. Lee asked how this would be done after the landfill is closed. No response was received at that or now. This is an area that needs to be addressed.

Landfill Gas Management

Section 7 of the Notre Technical Appendix B addresses landfill gas issues. This section appears to be essentially the same, if not the same, as the draft reviewed in 1995. As Dr. Lee pointed out at that time, there are many questions as to the reliability of the modeling approach used to predict landfill gas production rates. Among them are the inherent inaccuracies estimating the moisture content of the wastes. Others include whether the plastic garbage bag issue has been properly considered in modeling gas production.

Landfill Gas Collection and Disposal

Information on landfill gas flaring is provided on pages B.7-25, 26, and 27. In his review of the 1995 draft of this section, Dr. Lee pointed out that recent work in England (Eden, 1993) indicated that the typical landfill gas flare produces dioxins. Notre/Golder has chosen to ignore this information and has not addressed the dioxin issue. This EA document should be returned to Notre with specific instructions to provide information on how the proponent plans to monitor for and control dioxin emissions from landfill gas flares should this be a problem at this proposed landfill.

Monitoring and Reporting

Surface Water Monitoring

Surface water monitoring is discussed on page B.10-5. This section makes the same kinds of statements as contained in the Addendum G2 Surface Water Quality 1996. As discussed in Dr. Lee's 1995 comments as well as these 1996 comments on the Notre EA documents, the surface water monitoring program is significantly deficient compared to that needed to properly monitor surface waters for potential impacts of regulated and unregulated constituents in the landfill leachate. The key omission is the failure to include chronic aquatic life toxicity monitoring. Basically, the proponent needs to start over with respect to developing and describing a proper surface water monitoring program for this proposed landfill. Without it the Environmental Assessment document should be considered inadequate.

Groundwater and Leachate Monitoring

A discussion on groundwater and leachate monitoring begins on page B.10-8. On page B.10-11 the statement is made,

"Monitoring of groundwater quality in the property boundary wells will be carried out to demonstrate that there are no off-site impacts on surrounding groundwater quality above the Reasonable Use Policy guidelines established by the Ministry of Environment and Energy."

As discussed in Dr. Lee's 1995 comments on this section, such a statement is highly superficial and ignores the fact that it is not possible to reliably monitor fractured rock systems for leachate transport. The monitoring well array provided by Notre/Golder in Figure B.10.1 shows that monitoring wells are going to be spaced hundreds of meters apart around the landfill. This monitoring well spacing is grossly deficient compared to that needed to detect leachate migration in a homogeneous sand system, much less a fractured rock system such as that which occurs at the Adams Mine site. Notre/Golder is providing unreliable information on the ability to adequately monitor groundwaters at the landfill property line to ensure that leachate-polluted groundwaters do not cross the property line.

Because of the inability to reliably monitor leachate-polluted groundwaters at the landfill adjacent property line, Dr. Lee suggested in his previous comments that the landfill developer should be required to develop and implement a groundwater production well incipient contamination monitoring program that is designed to monitor for leachate entering a production well before significant harm has occurred. The production well monitoring would be based on monitoring every existing well, and those that are developed in the future, on a quarterly basis in perpetuity within the potential sphere of influence of groundwater pollution by the landfill. A worst-case (fastest travel time) approach would be used to predict when it is necessary to initiate the production well monitoring. The monitoring would be done by a independent third party firm who would report to the potentially impacted individuals but be funded by the landfill owner. The funding would be secured in a dedicated trust fund of sufficient magnitude to ensure that funds would always be available to provide for monitoring of all production wells within the potential sphere of influence of the landfill.

Reporting

Information on a Citizens Advisory Committee is provided on page B.10-22. It will be important that a properly constituted committee be set up that will represent the interests of the public potentially impacted by the proposed landfill, otherwise it will have little or no credibility.

The proposed monitoring program is listed beginning on page B.10-25. Some of the deficiencies in this table have been discussed elsewhere and are summarized below. They include, on page B.10-27,

the use of monthly event composites,

an insufficient number of parameters monitored at insufficient frequency for potential surface water impacts,

an insufficient number of parameters measured in the groundwater monitoring approach,

the use of acute toxicity tests rather than chronic toxicity tests to measure the adequacy of treatment of the leachate treatment system,

failure to monitor for dioxins in landfill gas emissions,

failure to provide information on what measurements would be made as part of the biological tissue analysis, etc.

failure to conduct the pre-operational water quality monitoring reliably, especially with respect to the use of analytical methods with sufficient sensitivity.

Overall, the monitoring program as presented in this document is highly deficient and should be redone by the proponent.

Remedial Action/Contingency Plans

The hydraulic conductivity of the drainage blanket is expected to be greater than 10^{-4} cm/s (page B.11-2). This same value is mentioned earlier in the text. This is a low permeability for a drainage layer. Such permeabilities are well known to plug fairly rapidly with municipal landfill leachate. This issue was raised in Dr. Lee's previous comments on the 1995 draft. It was not addressed in the 1996 final document, with the result that there is a significant potential threat for plugging of the drainage blanket. This issue alone should stop the development of this landfill until it is properly addressed, which, as discussed above, would include monitoring for leachate build-up within the wastes and the in-waste pumping of leachate should such build-up be found at any time in the future while the leachate represents a threat to public health, groundwater resources and the environment.

Under Table B.11.1, covering contingency action plans, no mention is made of any action plans designed to clean up the polluted groundwaters should the estimates of contaminating lifespan, etc. prove to be incorrect and substantial offsite groundwater pollution occurs. This is one of the issues Dr. Lee raised in his discussions of the 1995 draft program that was developed for Metro Toronto. It is unclear whether the proponent plans to provide for the necessary public health protection and restoration of polluted groundwaters should problems develop with the proposed landfill.

(Design and Operations - South Pit (1996) - Attachments)

Modeling of Drainage Layer Effluent Quality and Flow Rate

Introduction

Technical Appendix B, Attachment BB, devoted to modeling drainage layer effluent quality and flow rate, is one of the most important parts of the Environmental Assessment documents submitted by the proponent. In the fall of 1995, while serving as a peer reviewer for the Metro-funded AMPLC, Dr. Lee provided detailed comments on the draft Attachment BB Modeling of Contaminant Concentrations that was made available to him in late November 1995. Prior to that time Dr. Lee had discussed some aspects of this modeling with Metro's consultants' staff, where he had requested copies of back-up information which would enable him to review the details of the contaminating lifespan calculations. While this material was not made available to him in time to be included in his review of Metro's consultants' Attachment BB, Dr. Lee subsequently did obtain this material and has conducted a review of it.

He finds the approach that was used in determining Metro's consultants' estimated contaminating lifespan can best be characterized as a simplistic quantification of the hydrodynamics and chemistry/biochemistry of the processes that occur in municipal solid waste landfills so they could be "modeled." Dr. Lee is well acquainted with the landfill waste management literature and the fact that there are no reliable models of landfill processes which can be used to predict contaminating lifespans. While it is possible to use models of these processes and, thereby, present results that may seem credible, such modeling is nothing more than educated guessing. While Dr. Lee suggested to SENES/Golder staff possible ways to verify this modeling approach, they have chosen not to do so.

A review of the Notre December 1996 Attachment BB shows there have been some changes from the Metro Attachment BB developed about a year earlier. However, the fundamental issues of concern with respect to the reliability of the approaches used in estimating the contaminating lifespan have not been addressed. A presentation of these modeling issues would have included a discussion of the expected reliability of the modeling effort and of how sensitive the modeling results are to a change of assumed parameters. No information of this type was provided. The modeling results were presented as though they were factual and were subject to limited error. In fact, the modeling results could readily be in highly significant error.

Attachment BB presents the Notre predictions of the leachate characteristics that will occur over time at the base of the landfill in the South Pit. Page BB.1-2 states,

"As will be demonstrated in this Attachment, a period of approximately 100 years following the end of the landfilling represents a reasonable duration for the pumping phase. The actual duration of the pumping phase will be determined from measurements of drainage layer effluent quality and may be less than or greater than the predicted 100 year time frame."

As discussed herein, the 100 year pumping phase estimates are likely in significant error. Other Notre documents, such as the Environmental Assessment Overview and the Environmental Protection Act Summary, which were developed by the proponent, state that the 100 year period is a reliable estimate and therefore the "contaminating lifespan" is less than the expected service life of some of the non-maintainable leachate management components such as the drainage layer. The facts are that Attachment BB indicates the reliability of the 100 year estimate is unknown, and the pumping phase could be greater than the predicted 100 years. This is of significance since this means the contaminating lifespan of this landfill could be greater than the expected service life of some of the components of the leachate management system, with the result that this landfill cannot be approved as proposed.

In light of the above, the operator should develop a dedicated trust fund, derived from disposal fees, of sufficient magnitude to remove (mine) the wastes from this landfill and properly manage them for as long as the wastes represent a threat. Further, this dedicated trust fund should be of sufficient magnitude to remediate any contaminated groundwaters that occur in the vicinity of the landfill as well as off-site of the landfill to stop the spread of the leachate-polluted groundwaters through the region.

Leachate Characterization

Notre's estimates of leachate characteristics are presented on page BB.2-1. On the bottom of this page is a listing of the so-called "predominant anions and cations." A review of this list shows that it does not include one of the most important anions in leachate (chloride). As discussed in other documents, chloride is projected to be a pollutant in this landfill through excessive concentrations in the leachate for over 1,000 years. It should be listed on page BB.2-1.

Leachate Contaminants Considered in Assessment

The organics that the proponent expects to be present in leachate developed at the proposed Adams Mine site landfill are listed on pages BB.2-2 and BB.2-3. As discussed in the 1995 comments on this topic, there are many thousands of organics that are present in leachate which are not considered in this approach. These include a variety of hazardous and deleterious chemicals. A properly developed environmental assessment would have discussed this issue.

As Dr. Lee has discussed previously, he is particularly concerned with the issue of modeling vinyl chloride in the leachate. As he has commented, Dr. Lee finds that the approach that was used by Metro's consultants in the 1995 reports with respect to addressing vinyl chloride issues was inadequate from several perspectives. Vinyl chloride is an important constituent in municipal landfill leachate that must be properly considered. Table BB.A.1f presents the modeling results for vinyl chloride, where after 200 years, the concentration of vinyl chloride in the leachate is predicted to be 0.1 g/L. At 100 years, it is predicted to be 0.7 g/L. While Notre utilized an Ontario drinking water objective of 2 g/L as the critical concentration for vinyl chloride, the proponent should have discussed the fact that this critical concentration is subject to some controversy and that the California Department of Health Services has critically reviewed the hazards that vinyl chloride represents in drinking water and established a drinking water maximum contaminant level of 0.5 g/L. Therefore, if the more protective approach is used, vinyl chloride would still be hazardous in the leachate based on the Notre predictions well beyond the 100 year contaminating lifespan.

Another aspect of this situation that is of importance is the 25 year half-life that the proponent has assumed in its modeling of vinyl chloride behavior in the landfill. Dr. Lee has checked further into the origin of that value and found that it could readily have limited reliability. While Notre, on page BB.3-6, states,

"The analysis gave apparent half-life values which are up to one order of magnitude less than the values used for the modeling. Therefore, it is considered that the half-life values used for modeling, which were obtained from Rowe (1994), are conservative."

Dr. Lee has reviewed the materials by Rowe and the origin of the materials used by Rowe, and found, contrary to the statement made, these values are not necessarily "conservative."

Vinyl chloride is well known to be highly persistent in a landfill leachate environment. This persistence could well extend beyond the half-life of 25 years. In fact, based on what is known today, it should be assumed that vinyl chloride's half-life is infinite, i.e. it is largely a conservative chemical in the landfill environment with respect to degradation. There are, however, a number of reactions that occur in a landfill environment that tend to produce vinyl chloride from other, less hazardous

constituents that are commonly part of the municipal solid waste stream. Changing the half-life of vinyl chloride to a more appropriate, defensible value that more reliably reflects its behavior in a landfill will significantly change the contaminating lifespan of the proposed Adams Mine site landfill.

Similar problems exist with respect to the modeling being conducted by the proponent for other constituents. For example, Table BB.A.1b presents the results of Notre's modeling of ammonia, where the proponent assumed that ammonia would have a half-life of 20 years in the Adams Mine site landfill. Ammonia is one of the decomposition products of organic nitrogen compounds in landfills. Contrary to the approach used by Notre,

ammonia does not degrade in the landfill environment. To assume ammonia will degrade with a half-life of 20 years is inappropriate. Even though the modeling approach used for ammonia is in error, it still predicts that ammonia will be a problem in leachate well after the 100 year contaminating lifespan that Notre indicates will be applicable to this landfill. More appropriate calculations of ammonia's expected behavior in this landfill would show that excessive concentrations of ammonia can be expected to occur effectively forever and certainly for more than 100 and possibly 1,000 years.

Assuming that the proponent's modeling of lead is correct, the concentrations of lead in the leachate during the gravity drainage phase operations will be in excess of the drinking water standard for lead used in Ontario of 10 g/L for over 2,000 years (see Table BB.A.1i). Similarly, from Table BB.A.1p, the Notre estimated total dissolved solids in the leachate at the bottom of the landfill after 2,000 years will be in excess of 700 mg/L. These concentrations would represent a significant detriment to the use of the groundwaters contaminated by this leachate for domestic and some other purposes.

In his previous 1995 comments on this modeling, Dr. Lee raised questions about the reliability of the waste hydraulic conductivity assessments that have been used. Examination of Figure BB.2 shows that there are little data to support the position that the hydraulic conductivity of the deeper waste will be on the order of 1×10^{-6} cm/s. For shallower wastes, where there are multiple measurements at various landfills, the range of the hydraulic conductivities extends over 100-fold.

Methodology for Modeling Drainage Layer Effluent Quality

Dr. Lee has also pointed out that the movement of moisture through wastes of this type is likely to be primarily through channels and not as a uniform wetted front. To assume, as the proponent has done in Attachment BC that only "10% short-circuiting" will occur in the transport of leachate through the wastes, almost certainly underestimates the real transport that will occur through the Adams Mine wastes. The hydrodynamic modeling of leachate characteristics could also be in significant error.

Predicted Drainage Layer Effluent Flow Rate and Quality

Further, Dr. Lee pointed out in his 1995 comments that the approach used to estimate the amount of leachate that will be generated in the landfill involving the use of the US EPA's HELP model is certainly in error. Notre, in its BC Attachment, has persisted with trying to use the HELP model to predict the moisture infiltration rates for this landfill over thousands of years. This approach certainly underestimates the leachate generation that will occur in this landfill.

Dr. Lee raised the density issue with Metro's consultants in the fall of 1995 when he first became aware of the approach that they were proposing to follow with respect to developing the Adams Mine site landfill. Notre's consultants state

"The results of the modeling indicate no significant effect of the predicted densities on inward groundwater flow (i.e. hydraulic containment is maintained) . Page BB.4-4

Dr. Lee raised this issue because of the work of Dr. John Cherry who has shown that municipal solid waste leachate tends to be denser than water and, therefore, tends to sink in an aquifer system. The above quoted sentence, however, does not address the issue of concern to Dr. Lee when the landfill is operating in the gravity flow phase. Would the density be sufficient to cause some of the leachate-polluted groundwaters to fail to be collected in the collection system? This issue still needs to be addressed.

Contaminating Lifespan of the Landfill

On page BB.5-1 the proponent is defining contaminating lifespan of 100 years only with respect to surface water impacts. While these are of concern, groundwater impacts are of equal concern. With respect to the operation of the landfill, the adverse impacts on groundwater quality must be considered since the highly experimental approach that Notre proposes to use to collect leachate during the gravity drainage phase of operation could readily fail to collect all leachate, with the result that there will be groundwater pollution that is not managed by the proponent's proposed approach. This is of particular concern since the perimeter groundwater monitoring wells that Notre proposes to use to detect the failure of the system to collect leachate have low probability of detecting leachate-polluted groundwaters before they trespass under adjacent properties.

RATAP Model

Beginning on page BB.B-1 is a discussion of the RATAP model. Dr. Lee has examined the original publications that present the RATAP model and finds it is an inappropriate model for use in the Adams Mine site landfill situation. That model was developed to try to predict the rates of acid production from sulfide-bearing mine waste tailings. That system is quite different from the generation of leachate in a municipal solid waste landfill. At best, it would be a fluke if there was any relationship between the modeling results from RATAP and what actually happens in the Adams Mine site landfill.

Service Life of Drainage Layer

Biological Clogging of the Drainage Layer

Attachment BD presents a discussion of the service life of the drainage layer which focuses on the ability of the drainage layer to transmit leachate generated in the waste to the leachate removal system from the landfill. When Dr. Lee reviewed the draft of this section in 1995, he found the approach used by Metro's consultants to estimate clogging of the drainage layer to be invalid. Some of the same issues exist in the proponent's discussion, where, in the first paragraph of BD.4-1, it is stated that the clogging is due to calcium precipitation. A reference is given to Brunne (1991). However, the Brunne reference is not cited in the Notre report where it should be or, as far as Dr. Lee can tell, anywhere else. Those familiar with landfill leachate know clogging is due to much more

than just calcium precipitation. The approach used by the proponent to estimate clogging based on the information presented on pages BD.4-3 and BD.4-4 based on calcium precipitation is invalid. It fails to consider other mechanisms of clogging besides calcium precipitation.

As Dr. Lee has discussed previously, it is well known that leachate clogging is a serious problem. This is evidenced by the second paragraph on page BD.4-1, where, according to this paragraph, Dr. Rowe has found four orders of magnitude reduction in hydraulic conductivity in approximately a three-year period. In his previous comments on this issue, Dr. Lee indicated that one of his primary concerns is the buildup of leachate above clogged layers between the bottom or within the wastes and the drainage layer. The low permeability of the wastes predicted in the lower parts of the landfill could readily result in leachate pooling in the upper parts of the landfill which, through biological and chemical clogging, lead to a bridging of the drainage layer and a head that would tend to drive leachate into the surrounding geological strata. The issue of the expected behavior of leachate within this landfill is still far from being adequately described.

"Worst-Case" Scenario

Attachment BE discusses a potential failure scenario for the landfill containment system in which leachate fills up within the landfill and moves out through the sides of the Adams Mine site pit. This analysis appears to begin to address Dr. Lee's previously made comments of a landfill applicant being required to conduct a plausible worst-case scenario evaluation of the potential failure of the leachate management system and groundwater monitoring systems to detect groundwater pollution before widespread pollution occurs. The results of the Notre failure scenario evaluation show that there would be significant off-site adverse impacts due to chemical constituents in the leachate for both surface and groundwaters. While the proponent implies that, should this situation occur, remedial action could be implemented to address it, to Dr. Lee's knowledge, there is no assurance that adequate funds will, in fact, be available over the infinite future to implement remedial action. This issue must be more appropriately addressed than it is now, where, as discussed in Dr. Lee's 1995 comments, a true plausible worst-case scenario failure evaluation is made in which the landfill owner would describe how this failure will be detected for as long as the wastes in the landfill represent a threat, i.e. certainly thousands of years. Further, the magnitude of the funding that could be needed, including waste exhumation (mining), should be estimated, and the landfill owner should describe where the funds needed to address the problem will, in fact, be derived. Of particular importance is that the landfill operator establish a dedicated trust from disposal fees of sufficient magnitude to ensure that adequate funding will be available at any time in the future to prevent this landfill from causing off-site adverse impacts in surface and groundwaters of the region.

One of the problems with the Notre evaluation of what is called the hypothetical, non-hydraulic containment scenario is that apparently the proponent is still relying on the HELP model to estimate leachate generation rates. The actual rates of generation and,

therefore, the loss of leachate and the associated impacts could be significantly different than those predicted.

Leachate Treatment and Disposal

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Attachment BF is devoted to leachate treatment and disposal. It should be pointed out, as discussed elsewhere, that the estimated concentrations of constituents in the leachate, as presented in Table BF.2.1, could be in significant error due to the unreliability of the modeling approaches used.

Notre proposes to use the PACT system for treating the leachate. As Dr. Lee has discussed previously, it is his finding that this approach, if properly implemented and maintained, can produce an acceptable quality leachate for most parameters. The key is the adequacy of monitoring the effluent and downstream receiving water impacts to be certain that the operator maintains the system properly and that any impacts due to unknown hazardous or deleterious constituents in the leachate that are not removed by the PACT system are detected before wide-spread harm occurs. Further, at that time, funds should be available to ensure that the appropriate modifications of the leachate treatment system can and will, in fact, be implemented should this prove to be necessary. As it stands now, there is no assurance that the operator will make the commitment to provide that level of protection for public health and the environment.

In his review of the 1995 leachate treatment approach, Dr. Lee recommended the PACT system-treated leachate be discharged to a wetlands for additional treatment, especially for potential removal of unknown hazardous constituents. Notre is proposing to adopt such an approach. It appears that the proponent has found that the original approach proposed by Metro's consultants to Metro for managing leachate would not protect Misema River water quality.

Leachate Treatment and Disposal

Attachment BF, discussion of the proposed constructed wetlands, discusses some of the aspects of the benefits and potential problems associated with the use of wetlands for wastewater treatment. The one area that is not discussed is the fact that wetlands systems can release pollutants at a high rate during certain times of the year. For some constituents, they tend to store conservative pollutants and release them at one time during high flows, especially those that occur during non-active growing seasons for the wetlands vegetation. Such releases of pollutants could be detrimental to downstream water quality. This issue should have been discussed since it was previously brought to the attention of Metro's consultants in Dr. Lee's 1995 comments on the use of a wetlands system in treating leachate.

Several options for management of the leachate treatment plant residues are discussed on page BF.2-41. They range from off-site disposal to putting the residues in the open or

closed Adams Mine site landfill. Additional information is needed on the landfill disposal approach with particular regard to how this disposal would take place before the viability of this option can be considered.

Surface Water Quality 1996 Addendum G2 - December 1996

Introduction

Additional sampling covered the period March to November 1996 (page G2.S-1). However, only March to August sampling period data are available in this report. It is noted that a supplemental report will be prepared. This supplemental information is not yet available since sampling is still ongoing. It is expected to be released in spring 1997. The public should have an opportunity to review and comment upon all the relevant data. Further consideration of this EA should be deferred until these results and any others that are still underway are released to the public.

Methods of Assessment

Current use of the downstream waters, Boston Creek, Misema River, Blanche River, Round Lake and Lake Timiskaming are discussed on page G2.2-2. It is pointed out that there is use of these waters for municipal water supply and possibly for agricultural water supply including livestock, and the waters are important with respect to aquatic propagation and terrestrial life. It is important in conducting a review of these issues to consider not only the current situation but also the possibility of development in the future which would be dependent on these waters.

The fact that the discharge of the treated leachate to the Misema River is hydraulically connected to a large aquatic resource system is of concern. This means that fish could bioaccumulate regulated as well as unregulated hazardous chemicals present in the discharge of the treated leachate to the Misema River which, through fish movement, could expose people at considerable distances from the leachate discharge point to hazardous chemicals. While it is possible to monitor the fish for the limited number of regulated chemicals for excessive bioaccumulation, such monitoring cannot be assumed to be protective of public health and the environment because of the likely presence of unregulated highly hazardous chemicals in the wetlands discharge of treated leachate to the Misema River system

The headings Water Chemistry and General Chemistry are used on page G2.2-2. The term "chemistry" is incorrectly used. The section does not address chemistry per se which involves the reactions of constituents; what is covered here are chemical characteristics.

The statement on page G2.2-3 that "TDS measures dissolved acids, caustics and salts in the water." is incorrect. It measures some of the components of the dissolved acids, not all of them. The statement on this page that "Total suspended solids (TSS) measures the load of particulate matter..." is incorrect. It is not a measure of load; it is a measure of concentration of particulates in the water.

The statement in the next paragraph that hardness is a measure of the amount of polyvalent metal ions that is related to aesthetic quality of the water is an incorrect assessment. Hardness also causes scaling in equipment such as hot water heaters and other heated elements. This is much more than an aesthetic problem; it is a significant economic problem to those who are impacted by elevated hardness which will shorten the life of appliances in households or of agricultural equipment.

The statement in the following paragraph that "...(BOD) characterizes the likelihood of biochemical processes depleting the oxygen supply..." also reflects a lack of understanding of basic processes. BOD is a measure of the biological oxygen demand of the water. By itself it cannot be used to characterize oxygen depletion. This has to be considered on a site-specific basis.

Under Major Ions, it is stated on page G2.2-4 that calcium, potassium, and sulfate are conservative chemicals. There are many situations where calcium, potassium, and sulfate are not conservative chemicals since they enter into various types of chemical reactions.

Under the heading, Bacteria, the authors have failed to discuss other types of pathogens which are present in domestic solid waste such as enteroviruses and cyst-forming protozoans. There are substantial amounts of human fecal material in municipal solid wastes through the disposal of diapers in the solid waste stream. Diapers can represent up to several percent of the solid waste stream and therefore municipal solid wastes have appreciable human as well as animal fecal material which can serve as an important source of pathogenic organisms for people. This is a significant omission in the proponent's report in that it fails to address these issues properly, especially the presence of pathogenic viruses in the landfill leachate. Viruses would be readily transported through the fractured rock system located at the Adams Mine site.

Existing Environment

The statement is made, under Existing Water Quality Data on page G2.3-3, that the overall arithmetic mean of values is very susceptible to these influences, and the median is often a better representation of the true typical conditions in the waterbody. This statement is inaccurate. Chemicals do not affect organisms based on their average concentrations. The "concentration-duration of exposure" relationship must be considered in evaluating potential harm. The key issue in reviewing data of this type is whether there are conditions that are adverse to aquatic life. These cannot be judged by the mean or median values. The use of the mean - median value can skew the values in favor of allowing greater discharges of pollutants to the Misema River. Such an approach can readily result in harm to the river through inadequate treatment of the leachate. Unless shown otherwise, it has to be assumed that the extreme values could be adverse to aquatic life.

Local Monitoring Data - Surface Water Quality Program

Regarding Laboratory Measurement (page G2.3-34), Notre/SENES indicates that it did not select a laboratory that could do analyses of water with adequate detection limits. This situation represents a deficiency in the analysis. There must be adequate detection limits in order to be able to reliably determine the concentration of the constituents below critical levels.

The tailing pond water discussion on page G2.3-34 simply presents the data without any discussion of their implications. This is another significant deficiency in this report. The fact that there is a high oxygen demand in the hypolimnetic waters is a significant factor that must be considered in terms of potential impacts of the tailings on water quality.

Table G2.3.16 on page G2.3-37 presents data for station L on the Misema River. It is seriously deficient. The presentation of the mean, median, maximum, and minimum of a single sample is meaningless. The same problem with presentation of information occurs on page G2.3-28 for station J on the Misema River. The data in table G2.3.18 for station C on the Misema River do not include the temperatures at which the conductivity measurements were made. This should be reported.

The chromium analyses that were made in this study had a detection limit of less than 5 g/L. While it is not indicated in the text, this is a problem. Environment Canada has reported that chromium VI is toxic at less than 1 g/L. This table also indicates that the Canadian standard for chromium applicable for this situation is 100 g/L. This is 100 times the value Environment Canada has found to be toxic to some forms of aquatic life (Canadian Environmental Protection Act - Priority Substances List, Assessment Report, 1995). This shows the fact that the so-called PWQO and IPWQO (Interim Provincial Water Quality Objectives) values that were used by the proponent do not reflect current information in Canadian publications, much less the world publications, on the toxicity of some constituents of concern to aquatic life in the Adams Mine site situation.

This same table shows that the Canadian standard for mercury used in this study is inadequate to protect people, especially pregnant women, from excessive mercury ingestion through bioaccumulation in fish tissues. The same is true for selenium. The selenium standard used as a critical concentration is inadequate to protect aquatic life and wildlife. In addition, the analytical methods used for mercury do not have sufficient sensitivity to measure it at concentrations that can bioaccumulate to excessive levels in fish, rendering them dangerous to people who use them as food.

The drinking water standard used for arsenic is at least 50 times and probably 100 too high to protect people from cancer. Water containing arsenic above a few micrograms per liter should not be consumed.

The statement is made on page G2.3-53, in connection with the reliability of the phosphorus measurements,

"While the measured levels are not inconsistent with observations on the Blanche River they are not believed to accurately reflect the level of eutrophication of the Misema River."

This statement shows a lack of understanding of basic eutrophication nutrient situations. It is not possible to judge levels of eutrophication based on a single nutrient concentration.

The Analysis of Mercury and Methyl Mercury states,

"The 1996 monitoring program was designed to estimate the potential impacts of mercury and methyl mercury by comparison to the existing PWQO for mercury." (page G2.3-54)

It is well known, as discussed in Dr. Lee's previous comments on the initial draft of the SENES report on surface water monitoring released in 1995, that the SENES studies do not show a good understanding of the potential significance of mercury as a pollutant. Inadequate procedures are being used to detect mercury at potentially critical concentrations.

A discussion of the fact that Notre/SENES tried to use a more appropriate analytical procedure is found on page G2.3-55. However, it is well known that procedures that measure mercury down to only 0.03 "g/L" do not detect mercury at sufficiently low levels to avoid excessive bioaccumulation in fish. (It appears that the detection limit listed for mercury was incorrectly listed. Rather than using g/L it appears that it should have been ng/L, based on Table G.2.3.31.)

The statement is made mid-page on page G2.3-55, "Both the mercury and methyl mercury values are low, similar to oligotrophic natural, undisturbed lake waters of the Canadian Shield." The key issue that has to be addressed is the actual mercury concentrations in fish. This can occur from atmospheric deposition of mercury only. Inadequately treated leachate discharged to surface waters can aggravate this situation. As Dr. Lee has pointed out previously in commenting on the inadequate work conducted by SENES on behalf of Metro, the key to a proper assessment of mercury problems is an assessment of mercury present in fish tissue. Without it, it is not possible to judge whether there is excessive mercury in the surface waters near the Adams Mine area at this time.

The fact that inadequate analytical procedures were used to measure the concentrations of chlorinated hydrocarbons, pesticides and PCBs in fish samples is discussed on page G2.3-56. This is a significant gap in the information that is needed to compare existing concentrations at this location and is needed to do a proper environmental assessment of the proposed project.

A discussion of sediment data is presented on page G2.3-65. The MOEE sediment guideline values cannot be defended as being reliable.

In 1995, while serving as a peer reviewer on behalf of the AMPLC, Dr. Lee provided detailed comments on the then draft SENES reports covering surface water quality issues, pointing out that SENES had not adequately addressed, at that time, many aspects of surface water quality that needed to be addressed in a meaningful way if adequate results were to be available for a proper environmental assessment. While it appears from reviewing the Notre/SENES 1996 report that there has been an attempt to address some of the issues Dr. Lee raised, in several respects the approach that was followed reflected a lack of knowledge on how to properly investigate the issues of concern. There are still problems with inadequate sensitivity used in analytical methods and inappropriate interpretation of data that must be dealt with before a proper environmental assessment can be said to have been conducted at this site. Notre should redo much of the surface water section and may find it profitable to consult on the most appropriate methods for conducting such studies.

Dr. Lee has previously discussed the inadequate approaches that were used by SENES in sampling the pit waters in 1995 as well as in interpretation of the results. They have been repeated in the existing documents. Notre should start over with respect to properly sampling and interpreting the data on the pit water characteristics. At this time there is inadequate information to characterize the potential impacts of the pumping of these waters to the surface and releasing them to the environment to be sure that they do not represent significant adverse impacts.

Selection of Preferred Discharge Location

Mention is made of Phase 2 of the landfill operation lasting approximately 120 years. "Phase 2 covers a period...from initial operation of the site as a landfill to the termination of pumping from the bottom of the pit..." (page G2.4-5). As Dr. Lee discussed in his previous comments, SENES et al, in making an estimate of the period of time for Phase 2, have significantly underestimated the time that will be needed to achieve a leachate characteristic for the termination of pumping, i.e. gravity drainage.

Phase 3 extending beyond the 120 years is mentioned on page G2.4-6. For all practical purposes, Phase 3 should be considered to extend indefinitely.

Net Effects

Net Effects of Pit Dewatering

Beginning on page G2.5-1 is a discussion of the effects of alternative approaches for disposal of mine pit water as well as leachate. A comparison is made on page G2.5-2 between the quality of water discharged in the south pit to the effluent limits from the metal mining sector for Ontario. Such a comparison is inappropriate. The metal mining sector discharge effluent limits are not based, necessarily, on protecting the beneficial uses of the waterbodies.

Net Effects of Treated Leachate Discharge

Notre states "The reader is cautioned that it is not intended that the effluent quality must be better than the respective PWQOs [Provincial Water Quality Objectives] or ODWOs [Ontario Drinking Water Objectives]." (page G2.5-9). Notre plans to treat the effluent only to achieve minimum regulatory limits. As discussed herein, many of these limits do not reflect current knowledge in Canada or the US on the impacts of chemical constituents on aquatic life and other beneficial uses of waters. Since regulatory limits of this type are often changed, usually downward, the analysis that has been conducted should have considered the fact that many of the regulatory limits used for the evaluation will not be applicable for the time that the landfill will be operational. This could, and almost certainly will, require far greater treatment of leachate than is anticipated now.

The potential use a constructed wetlands for improving effluent quality from the treatment plant is discussed on page G2.5-15. The statement is made,

"Wetland systems have proven to be particularly efficient in removing nutrients (i.e. carbon, nitrogen and phosphorus species) and suspended matter, as well as, various trace contaminants (i.e. metals and organic compounds) from pretreated wastewaters."

While this statement is true during the active growing season, research that Dr. Lee did with his graduate students while he was teaching at the University of Wisconsin in the 1960s showed that wetland areas can export large amounts of pollutants during the high spring flow period. Dr. Lee has previously pointed this out to SENES.

Section 5, "Net Effects," contains considerable discussion of the results of modeling efforts for the various scenarios for landfill operation and treatment and disposal of the leachate after treatment. Extensive efforts have been made by Notre/SENES to use models of various types to predict the concentrations of constituents in the leachate produced in the landfill during various times of the landfill's contaminating lifespan. As Dr. Lee discussed in the fall of 1995, these modeling efforts have little technical merit. This process can, at best, be described as educated guessing using mathematics, which has limited ability to predict the concentrations of constituents in leachate.

Further, as discussed in Dr. Lee's previous comments on the deficiencies in this modeling approach used by SENES, this modeling effort ignores the fact that there are over 60,000 - 100,000 chemicals in commercial use today, and the municipal solid waste stream typically contains many thousands of chemicals that are unregulated and for which there are no standards. To assume, as Notre/SENES have done, that only a few regulated chemicals of the type that they considered would be key constituents in the leachate is at best naive and certainly inappropriate. It should be noted that at no place have Notre/SENES addressed in a satisfactory manner the issues that Dr. Lee has previously raised on the unreliability of the modeling approaches being used.

A key component of any environmental assessment is information on water quality and environmental monitoring program that the landfill developer proposes to follow to ensure that the environment, public health, and surface and groundwater resources are, in fact, protected from adverse impacts for as long as the wastes in the landfill and

contaminated groundwaters associated with the landfill remain a threat. The Notre Environmental Assessment is significantly deficient since it fails to provide detailed information on the monitoring program that will be carried out. Until the opportunity for the public to review this information has been provided, any decisions on the Adams Mine site landfill EA should be deferred.

In the fall of 1995, Metro Toronto and its consultants proposed to discharge the treated leachate and mine pit dewatering waters to the Misema River. In his review of Metro's proposed Phase I results, Dr. Lee indicated that if the project was to go ahead, it should include treatment of the mine pit waters to the degree necessary to be sure to protect public health, the environment, and the resources of the region as well as the interests of those within the sphere of influence of the proposed landfill. With respect to the treated leachate discharge, Dr. Lee recommended` against a direct discharge of the treated leachate to the Misema River as proposed, but, instead, the discharge should take place through a constructed wetlands.

It is encouraging to see that Notre has abandoned the originally proposed approach of managing leachate by direct discharge to the Misema River and is apparently adopting the approach Dr. Lee recommended of discharge to a constructed wetlands. As the treated leachate empties into the Misema River, however, there are still many questions that remain about the approach that the proponent will, in fact, use that should have been discussed in the Environmental Assessment documents in order that the regulatory agencies, the public, and others will have the opportunity to properly evaluate the potential problems associated with this aspect of the proposal.

Ecological Risk Assessment

Risk characterization for mercury is discussed on page G2.6-9. The authors have used a 0.5 g/g concentration of mercury in fish to protect fish consuming birds. This is based on an MOEE 1979 value. US EPA guidelines that have been issued in the past couple of years show, at least for humans, that concentrations of mercury in fish must be less than 0.1 g/g for people who consume one meal of fish per week. It would be expected that possibly even lower levels would be necessary to protect birds, since birds could be utilizing the fish of a region as a primary source of food. Basically, the risk characterization set forth in the Notre Surface Water 1996 Report, Addendum G2 does not reflect the information that is available today on the true hazards of mercury as a public health and environmental threat.

The ecological risk assessment for zinc on page G2.6-13 mentions that a SENES 1996 L/kg value of 19,000 was used as the zinc Kd for sorption by solids, rather than the more typical values of 100 to 1,000 L/kg. The SENES 1996 value was based on work that was done at another location. The coupling between water and sediments for a constituent such as zinc is highly site-specific, and it is inappropriate to assume that some extreme value found at one location is applicable to the Adams Mine site situation. The use of the 19,000 value makes the risk assessment for zinc conducted by Notre highly suspect.

Beginning on page G2.6-15 is a discussion of what is called Hazard Assessment Aquatic Toxicity. A review of the material presented in this section shows that the authors have chosen to use LC20 values. This approach is not protective. LC values (lethal concentrations to kill 50%) can be and often are higher than the values that are needed to protect the aquatic life from chronic toxicity effects. This assessment should have used the chronic toxicity values, not the acute values. Since the late 1960s scientist have used this approach to evaluate the potential toxicity of chemicals to aquatic life. Overall, the ecological risk assessment section is technically weak.

Monitoring and Contingency Plans

Beginning on page G2.7-1 are the Monitoring and Contingency Plans that the proponent proposes to follow. It is stated mid page that Notre plans to conduct the surface water quality monitoring during the "operational phase" for as long as leachate treatment takes place, which is estimated to last 100 years. There is uncertainty as to whether the operator will, in fact, maintain a high level of environmental monitoring for as long as the landfill represents a threat, which could readily be hundreds to a thousand or more years. Further, there are significant questions about how this monitoring will be funded for as long as the wastes represent a threat. Will the operator set aside a dedicated trust of sufficient magnitude to fund high levels of monitoring in perpetuity as may be needed? This issue should have been addressed.

It is stated on this page, in the last paragraph, that a flow-weighted composite sample will be collected monthly. Such an approach is inappropriate. Organisms do not respond to chemicals based on a flow-weighted composite. They respond based on a "concentration-duration of exposure" relationship. Individual concentration values should be measured to determine whether there are exceedances that are adverse to aquatic life. The flow-weighted composite can readily mask adverse impacts.

It is stated on page G2.7-2 that the details of the monitoring program will be worked out with MOEE staff. While this approach may be followed, it is inappropriate not to provide the details in the Environmental Assessment document. There are many examples where details of monitoring programs have been worked out between regulatory agencies and dischargers which subsequently are shown to be inadequate to protect public health and the environment. Therefore, it is necessary that any environmental assessment include the proposed details so these can be evaluated for their adequacy. Following this approach allows the public, and especially potentially impacted parties, to evaluate whether the MOEE's current approach toward addressing these issues would be protective of public health and the environment.

Overall Assessment

The Surface Water Environmental Assessment falls short of the assessment that is required in order for MOEE and the public potentially impacted by this landfill to review its potential impacts. One of the most significant deficiencies of the proponent's program is the failure to address the issues of aquatic life toxicity associated with the current pit

waters that are proposed to be discharged to the environment. Without aquatic life toxicity information on the proposed pit discharge waters, it is not possible to judge whether there are potentially significant problems associated with the proposed approach for managing the de-watering of the pits. There is also inappropriate information provided on excessive bioaccumulation of hazardous chemicals, such as mercury, within aquatic life. Overall, the Surface Water Quality Addendum G2 (1996) must be rejected as an incomplete and inappropriate discussion of environmental issues.

Bird Hazard and Health - Addendum C1 (1996)

Notre has released as one of its Environmental Assessment documents Addendum C1 "Bird Hazard and Health (1996)." This is an update of a previously developed consultant's report on bird hazards and health associated with the proposed Adams Mine site landfill. Dr. Lee found upon review of that draft report that it was significantly deficient and contained incorrect information. The Notre December 1996 report does include some additional field observations in September 1996 and some of the deficiencies found in the previous version of the report on this topic report have been addressed. It is now recognized that there are a number of types of birds that could readily be attracted to the Adams mine site landfill, and they represent a potential hazard to aircraft and other interests.

However, some of the major deficiencies remaining include a lack of discussion on key issues such as

determining what represents an excessive number of birds that would cause bird control action to be taken,

how the various actions would be initiated and

what specific methods would be applied, etc.

Without this information, it is not possible to determine whether the operator would, in fact, address the bird hazard problem in a meaningful way.

One of the issues that has been raised previously by Dr. Lee is the possibility of the birds spreading disease from the wastes to the local bird populations, including the agricultural community. While it was claimed, without adequate justification, in the Metro 1995 reports, that there was limited possibility for the garbage to transmit disease organisms from the Toronto area to the Kirkland Lake area which could then be transmitted from the garbage via birds to the local wild and domestic animal populations, insufficient attention was given to this issue by Metro's consultants and is not addressed in the Notre December "Bird Hazard and Health (1996)" report, Addendum C1.

Aquatic Biology - Addendum H1 - 1996

Notre conducted additional aquatic biology field work in 1996. This work is reported in Addendum H1 "Aquatic Biology (1996)."

It is stated on Page H1.2-8 that there was no indication that dioxins would be an issue in treated leachate. The basis for that statement is not provided. Basically, there is little information on dioxins in leachate. However, they are expected to be present since municipal solid waste contains combustion residues which are known to contain dioxins.

Another chemical that was not measured in fish tissue that should have been measured is selenium. The bioaccumulation of selenium is being found to be of significance to higher trophic level fish. Notre, as part of conducting a proper bioaccumulation study should also measure the selenium concentrations in fish tissue to establish the current levels of this potentially hazardous chemical.

Existing Environment Contaminant Levels

A discussion of contaminant levels in fish begins on page H1. 3-11. On this page, it is mentioned that,

"Mercury concentrations in most samples were below the provincial guideline of 0.5 g/g for the protection of aquatic life and fish-consuming birds (MOEE 1979) and the provincial guideline of 0.5 g/g for unrestricted consumption by humans (MOEE 1990)."

Since 1990 there have been a number of reviews on critical mercury levels in fish for use as food with the result that, in the past, the 0.5 g/g was considered satisfactory. Today, the US EPA uses a critical fish tissue concentration of about 0.1 g/g for people who are consuming fish at the level of one meal per week.

A review of the information presented in H1C Detailed Results for Chemical Analyses of Biological Tissue show that, in general, the chlorinated hydrocarbon pesticides were reported as "nd" (non-detect) in fish tissue. However, when a comparison is made between the LOQ (limit of quantification) "detection limit" used by the proponent in making these measurements to the critical concentrations of several of the chemicals of concern it is found that Notre failed to use sufficiently sensitive analytical methods to detect potentially hazardous chemicals in the fish tissue. This problem occurred for chlordane and PCBs, both of which are common important pollutants in fish tissue which represent significant threats to public health and wildlife.

Notre failed to analyze the fish collected for dioxins. Since dioxins are a potentially significant constituent in municipal solid waste streams and a common pollutant in fish tissue, Notre's failure to measure dioxins indicates a significant error. As part of properly conducting the pre-operational fish tissue biological assessment, the proponent must collect additional fish and conduct analyses of these fish for the chlorinated hydrocarbon pesticides, PCBs and dioxins using appropriate analytical procedures that have sufficient sensitivity to measure the constituents of concern at concentrations that are considered at this time to be potentially hazardous to public health and wildlife.

Table H1.3.4 on page H1. 3-12 shows that many of the fish collected in the 1996 studies had concentrations of mercury above what would be considered hazardous based on current US EPA guidelines. It appears, therefore, that there is already a mercury problem in the fish of the region and any additional discharge of mercury could be contributing to further problems.

Notre's Addendum H1 "Aquatic Biology (1996)" contains a section on a recommended monitoring program. The MOEE should impose a condition of approval on the part of the proponent to carry out this program.

Results of Benthic-Invertebrate Collections

In January 1997, (dated 1996), the proponent made available "Attachment H1E To Addendum H1 - Aquatic Biology (1996)." This attachment provides additional information on the benthic-invertebrate collections that were made in 1996 in the vicinity of the Adams Mine site as well as the results of additional mercury analyses of fish collected from the region. On page H1E. 2-3 Notre reports that MOEE required that the proponent's laboratory conduct an analysis of a "canned" tissue sample which contained mercury at known concentrations. This sample was submitted blind to Notre's laboratory for analysis. Attachment H1E reports "The initial analytical result for the canned sample was below the known value" This situation makes the mercury analyses reported by the proponent highly suspect.

Notre was required to reanalyze all the fish and invertebrate samples for mercury because of the highly inaccurate results reported for the standard "canned" sample. This data is presented in Appendix H1E-II. Examination of this data shows that for a number of samples there were changes between the initial analyses and reanalyses although in general the values are approximately the same for the fish samples. The data presented in this attachment shows that many of the fish samples from the Blanche River and the Misema River contain mercury concentrations that are above the US EPA recently developed guideline for excessive mercury concentrations in fish tissue.

This section of the report also contains a table on page H1E-1-9 which does not indicate what the numbers in the table represent. Are they the results of mercury analyses conducted on the types of organisms indicated? If so, what concentration units are being used?

Terrestrial Biology - Addendum H2 (1996)

Pages H2. 4-12 and H2. 4-13 discuss the inappropriateness of using 0.5 g/g critical levels for mercury. While the authors report that the proponent's consultants understand the unreliability of this value, the value is presented throughout all of Notre's documents as though it were appropriate.

In Dr. Lee's review of Metro's consultants' draft reports he pointed out that the issue of the hantavirus was not discussed. This prompted the proponent to include a section in the

Addendum H2 "Terrestrial Biology (1996)" devoted to this topic. While the section on pages H2. 4-32 through H2. 4-34 discuss deer mice hantavirus issues and makes a number of recommendations on approaches that should be followed to evaluate this problem when the landfill becomes operational, there is no assurance that the operator will follow these recommendations and commit to an aggressive program to ensure that the hantavirus does not become a problem that could be spread through the local community.

While the "Terrestrial Biology" addendum makes recommendations on monitoring programs, there is no commitment on the part of the operator to carry out any of these recommended programs. Without this, it is uncertain as to what will actually be done in the way of monitoring.

Public and Agency Consultation - Addendum A1 - (1996)

In Addendum A1 - Public and Agency Consultation, "Responses to Public and Peer Review Comments on the 'Internal Draft' EA Overview Document and Associated Appendices", Notre provides a response to issues that Dr. Lee and Mr. Gallaugher raised in their fall 1995 review of the Metro consultants' proposal for developing the Adams Mine site landfill. This section provides additional information to that covered elsewhere on why Notre's responses to comments are inadequate to address the issues raised.

Beginning on page 1 is a presentation "Response to G. Fred Lee - Dated 12 December 1995." Notre's response to the statement made in the December 12, 1995 comments to Metro Council was to discuss the situation as it existed. What Notre has failed to provide in that discussion on page 1 is the fact that the Metro consultants, many of which are now Notre's consultants, did not meet the agreed-to schedule that Metro had established and to which the consultants and peer reviewers had agreed for the peer review process. The slow rate at which some of Metro's consultants provided the information to the peer reviewers hampered the ability of Metro staff to develop Phase 1 reports that adequately considered the issues raised by the peer reviewers. Instead, the Phase 1 reports were "interim reports" which did not address many of the key issues that needed to be addressed regarding the ability of Metro to develop the Adams Mine site into a landfill that would be protective of public health and the environment.

On page 2 of Notre's 22 February 1996 responses to the issue of the potential for groundwater and surface water pollution by landfill leachate, Notre presents distorted information with respect to stating that "Dr. Lee contradicts his later statements." A review of the document submitted by Dr. Lee shows that at no time was there a contradiction on the issues of whether he found that the Adams Mine site could be developed into a protective landfill. Dr. Lee's statements throughout his review were that he found no fatal flaw which would preclude further work towards evaluating the potential for development. At no time did he present an unqualified statement that the Adams Mine site had been sufficiently well investigated to confirm that it was a suitable site for a landfill. Notre, in its response, has failed to provide the reviewers of the response with a full discussion of issues presented by Dr. Lee. Instead, they have quoted

part of one sentence in an attempt to distort the information provided by Dr. Lee for the purpose of trying to contrive a contradiction in Dr. Lee's statements.

It is important to understand that Dr. Lee's assessment that the site could be developed into a protective landfill was based on Metro being the developer. It would be able to provide the necessary funding to properly develop, monitor and maintain the landfill system. Dr. Lee's assessment of this situation has changed under Notre's development of the landfill. Notre has not fully committed to provide for full public health and environmental protection. Dr. Lee is now highly skeptical that the Adams Mine site under Notre's development will be developed into a protective landfill.

On page 3 of the responses, with respect to the service life of the leachate removal system, Notre responds to Dr. Lee's questioning about whether the service life of the leachate removal system has been reliably estimated by stating, "A conservative approach has been used to calculate the service life which includes maximum rates of clogging based on actual measured characteristics of biological growth." Notre's statement that a conservative approach has been used is unreliable As discussed on page 3, Dr. Lee has provided comments that his review of the contaminating lifespan calculations developed by Metro's consultants, now Notre's consultants, showed that an overly optimistic rate of decay of constituents in the landfill was calculated compared to what will likely occur. The contaminating lifespan of approximately 100 years is an underestimate of what will likely be the real contaminating lifespan of this landfill.

On page 4, "Leachate Generation Rates," Dr. Lee questioned the appropriateness of using the HELP model to predict leachate generation rates. This model assumes that the landfill cover will maintain its design characteristics in perpetuity, Notre has responded that higher infiltration rates through the final cover would reduce the contaminating lifespan of the landfill. That statement is not necessarily true. Higher infiltration rates, if they are passing through channels in the wastes, will not result in shortening the contaminating lifespan. Because of the lack of shredding of the wastes and the lack of even distribution of moisture at the top of the landfilled wastes, there will be limited opportunity for moisture added to the landfill to interact with the wastes, lengthening the contaminating lifespan. Adding more moisture through the channels that develop in the wastes will not significantly change the situation.

On page 5, Notre responds to Dr. Lee's comments concerning the need to revise some MOEE water quality standards by stating, "The standards adopted by the province for protection of public health, aquatic life and wildlife have undergone several revisions in recent years in response to new scientific information." This does not address the fact that these standards, for some constituents, are still out-of-date with respect to what is known about the impact of the chemicals on public health and the environment, i.e. the point raised by Dr. Lee.

On page 6, under Dr. Lee's comment with respect to unregulated chemicals, Notre's response is that the monitoring program considers both regulated and unregulated

chemicals. That statement is not true. There is no consideration given to the unregulated, hazardous chemicals that are present in the MSW leachate.

On page 6 under "Groundwater Quality Monitoring," Notre's response to the inability to monitor groundwater quality in fractured rock systems is that Notre considers the monitoring system to be reliable. This is a superficial statement to a fundamental issue that needs to be addressed, namely that it is impossible to reliably monitor water quality in fractured rock systems as is proposed with Notre's proposed approach. While on pages 6 and 7 as well as other places, Dr. Lee makes suggestions as to approaches that would provide for greater protection, Notre has responded to such issues as third-party monitoring that such monitoring may be applied to the Adams Mine.

On page 7 under worst-case scenario evaluation, it appears that MOEE, through their new draft regulations, may require that landfill applicants do a worst-case scenario evaluation of the type that Dr. Lee recommended in the fall of 1995. As a result, Notre's comments have been proven to be inappropriate.

On page 8, under "Remediation of Polluted Groundwaters," Notre's response does not address the issues raised by Dr. Lee. Notre maintains that there will be "no leaks to the surrounding groundwater." This landfill design is, without question, experimental. There could be polluted groundwaters arising from this proposed mode of operation. Therefore, there is need to develop a remediation approach for polluted groundwaters.

On page 8, with respect to funding for remediation, should the experimental landfill fail to function as described, Dr. Lee indicated that there should be sufficient funds available to remove the wastes from the landfill to stop further pollution. Notre's response, "Removal of the waste from the pits is not considered to be reasonable nor a practical proposition", reflects Notre's failure to provide for full public health and environmental protection. Before Notre or anyone else is allowed to undertake the development of this landfill funding should be set aside, of sufficient magnitude, to remove the wastes through landfill mining, if necessary. This is one of the costs that should be borne by the landfill developer as part of developing this site. Without it, the people in the area could readily find themselves with a situation where the amount of funds made available by Notre in accord with current MOEE contingency fund requirements are significantly deficient compared to those that will be needed under a private landfill development scenario where the developer has no ability to tax or levy fees against the waste generators. The burden for the adverse impacts will be almost certainly on the people in the area with little or no possibility of obtaining relief through funding that may be necessary to remove the wastes at some time in the hundred to a thousand or more years that this landfill will be a threat to surface and groundwater quality.

On page 9, under Dr. Lee's comments with respect to the appropriateness of using the Reasonable Use Policy, Notre's response does not address the basic issues raised by Dr. Lee. The Reasonable Use Policy ignores the fact that there are large numbers of hazardous or otherwise deleterious chemicals in municipal solid waste which could be adverse to the uses of groundwater contaminated by leachate. While the Reasonable Use

Policy is, as Notre states, used in landfills throughout the province, as Dr. Lee pointed out in experimental type landfills such as the proposed Adams Mine site landfill, it would be appropriate for the owner of the landfill to meet the standards used in the US of not allowing any concentrations of constituents derived from landfill waste to occur at more than 150 metres from the landfill at statistically significant concentrations above background. By rejecting this approach and holding to the Reasonable Use Policy, Notre is indicating to the people of the area that it will not provide the degree of protection that they should be entitled to should the landfill system fail to perform as proposed and there is pollution of groundwater by leachate.

On page 9, under Dr. Lee's comments on the adequacy of MOEE landfilling regulations in protecting adjacent property owners'/ users' health and interests, Notre fails to address the issues raised by Dr. Lee that there will be trespass of adverse impacts due to landfill gas, dust, noise, birds, etc. onto adjacent properties. This situation should not be allowed. The same situation applies to other impacts discussed on page 10 where it is clear now from Notre's December 1996 EA documents that Notre plans to use adjacent properties to dissipate adverse impacts of the landfill for dilution.

On page 12, under "Economic Evaluation" where Dr. Lee raised the questions as to whether the costs that have been projected by Metro's consultants reliably reflected the true costs of landfilling of the site, Notre has failed to address the issues raised and claims, without substantiation, that the costs originally projected are appropriate.

On page 12 with respect to Dr. Lee's comment on the development of the Adams Mine site landfill as a waste treatment system, Notre has attempted to distort Dr. Lee's comments by inferring that Dr. Lee implied that the Adams Mine site landfill as proposed would be a "dry tomb" landfill. That is certainly not the case. Even a cursory reading of Dr. Lee's comments and his publications on "dry tomb" landfills shows that this is not an issue for the Adams Mine site landfill. Further, the statement by Notre, "The shredding of wastes is not considered warranted." is based strictly on economic considerations without proper demonstration that the shredding would, in fact, increase the ability of the moisture added to the landfill to interact with the wastes and thereby reduce the contaminating lifespan. With respect to "Response to Gartner Lee - Letter dated November 30, 1995," Gartner Lee pointed out that Metro's consultants, SENES and Golder, frequently provided information without the supporting documentation which would enable a critical review of the material to be completed. Subsequently, Dr. Lee, as part of his review of materials was able to obtain the background documents mentioned by SENES and Golder and found that the materials that served as the background to the approaches used by SENES and Golder were not a valid basis in such areas as estimating contaminated lifespan.

Several of Gartner Lee's comments relate to their questioning the reliability of the Golder estimates of the contaminating lifespan, such as on page 14. Notre did not adequately address the issues raised by Gartner Lee in their February 23, 1996 comments as well as in the subsequently developed EA documents.

Beginning on page 17, in response to Dr. Lee's letter dated 29 November 1995, Notre provides comments to several of the points raised by Dr. Lee. While the responses are often that something could be done to address the issues, in fact, as shown by review of Notre's EA documents published in December 1996, Notre did not address these issues.

On pages 18 and 19, Notre has responded to a number of issues raised by Dr. Lee regarding the reliability of the estimates of the contaminating lifespan. Notre's responses, however, are superficial in addressing the issues raised by Dr. Lee. These issues still remain unresolved.

Page 21, under the unreliable information provided by Golder on the Puente Hills landfill which has persisted now into the Notre Design and Operation reports released in December 1996, Notre states "...Dr. Lee did not provide any information to assist in this regard." That statement is inaccurate. Dr. Lee provided quotes from the state of California Water Resources Control Board that specifically indicated that, contrary to the statements made by Golder, the Puente Hills landfill was, in fact, polluting groundwaters.

On page 25, in response to Dr. Lee's comments concerning the need to model unregulated hazardous chemical behaviour, Notre stated that since it and its consultants did not know of an unregulated chemical that was hazardous, it is inappropriate to try to model such a chemical. Dr. Lee pointed out that a properly conducted review would have considered the potential for a potentially hazardous organic to be present in the wastes which is more hazardous than vinyl chloride and that modeling of this organic, even though not specifically identified, should be part of the review process in order to gain a reliable impression of how the contaminating lifespan can change as the result of finding new hazardous chemicals in the waste leachate. Notre's has failed to follow a common-sense, environmentally protective approach with respect to this issue. If such modeling is done, it would be found that unregulated hazardous chemicals which are almost certainly present in the municipal solid waste stream will cause the contaminating lifespan of this landfill to exceed the expected service life of some of the components of the leachate removal system.

On page 26, Notre through its consultant, SENES, has provided an unreliable response to the situation that developed with respect to Dr. Lee requesting information following the meeting with SENES staff in September 1995. Following that meeting, Dr. Lee made specific requests for certain information. This information was not provided. When this information was not provided, Dr. Lee informed the PLC of SENES' failure. While SENES did eventually provide the information, it was too late to incorporate it into the comments submitted to Metro Council. Upon review of this information, however, it was found, as Dr. Lee suspected, that the modeling approaches for contaminating lifespan being used were not necessarily reliable and could easily be in significant error.

On page 27 with respect to Dr. Lee's raising the question about odours associated with the composting operations proposed for the landfill area, Notre states, "Odour problems are not anticipated if the potential composting facility is operated properly." Open-air

composting of municipal solid wastes including leaves and other organic residues causes a significant odour problem associated with almost every composting operation. Composting facility after composting facility has been shut down because of the inability to control odours. For Notre to respond that the odour problem would not likely occur because they infer that the composting will be operated to control odors is superficial, at best.

On page 27 under the landfill gas dioxin issue raised by Dr. Lee, Notre has failed to address the issue. Dr. Lee suggested, based on recent work done in England, that consideration should be given to the adequacy of the combustion of landfill gas in protecting public health and the environment. He suggested the landfill operator would test the gas for dioxins and take appropriate steps to control it if it is found. This is a reasonable, appropriate approach. Notre's approach, however, is to claim, in effect, that since no one has tested for dioxins in landfill gas flares in Ontario and therefore no dioxins have been found, that there is no need to test for dioxins, even though similar kinds of flares in England have been found to produce dioxins. It is responses such as this that cause the peer reviewers, Dr. Lee and Mr. Gallaugher, to conclude that Notre cannot be relied on to take the necessary steps to ensure that the Adams Mine site landfill developed under Notre would, in fact, be protective.

On page 32, under the issues raised by Dr. Lee on chromium standards, Notre's response is that total chromium should be limited to <500 g/L and hexavalent chromium should be limited to <50 g/L. The 1995 Environment Canada document entitled "Chromium and its Compounds" recommends a hexavalent chromium concentration of <0.5 g/L. The Environment Canada publications should have been mentioned by Notre in order that the public would be aware that the MOEE regulations on chromium are badly out-of-date.

Similarly, with respect to mercury on page 32, Notre discusses mercury being present in leachate at low concentrations of 0.3 g/L. 0.3 g/L is more than 10 times higher than the level the US EPA has established as a critical concentration for mercury in waters that could lead to excessive bioaccumulation in fish.

On page 41, Notre responds to Dr. Lee's questioning of the statements about the use of Stumm and Morgan species composition calculation approaches to estimate the actual species that will be present in the leachate. The response provided by SENES on this page is a superficial discussion of the chemistry of constituents in landfill leachate. The overly-simplistic modeling approach which does not adequately consider organic complexation in influencing the species composition used by Notre's consultants is of great concern with respect to the reliability of the modeling approach used for estimating contaminating lifespan.

On page 42, Notre is attempting to defend a 100-year contaminating lifespan estimate where they present a superficial discussion of issues, for example, with respect to ammonia and organics. A critical review of the original publications that was cited in this section as a source of information in support of the modeling approach shows that

there is insufficient information available to reliably predict how long these constituents will represent potential pollutants in the leachate.

With respect to the statement on chloride being a pollutant for over 2,000 to 3,000 years, again Notre has not addressed the issue that has been raised by Dr. Lee. Chloride is a constituent that can be a surrogate for many other constituents that could behave in a similar manner that are not now regulated.

On page 43, Notre states that if new, now unidentified constituents are found in the future which represent a greater hazard than the few chemicals that were selected for modeling, the modeling would be expanded to include these chemicals. However, Notre fails to address what would be done if the landfill is already constructed and the modeling of the newly identified hazardous chemicals shows that the contaminating lifespan exceeds the service life of key components of the leachate management system. Will Notre remove the wastes since the landfill could not conform to MOEE regulations of having a contaminating lifespan of less than the service life of key components? Notre has rejected the notion of removal of wastes. Where does this leave the residents of the area? Probably with a landfill that obviously will not protect their interests. To assert, as Notre has done, that the chemicals that they modeled represent the most hazardous chemicals that could possibly be present in the landfill and that it is safe to proceed with these assumptions without modeling a reasonable surrogate that could represent yet-to-be-identified hazardous chemicals is inappropriate and contrary to prudent public health and environmental protection.

On page 50, at the bottom of the page, in response to an error made by Metro's consultants about leachate not being generated until field capacity of the wastes is exceeded, Notre's consultants state, "Report has been modified to say some leachate may be generated prior to reaching the field capacity of the fill." However, in the December 1996 EA document, the same error that Dr. Lee originally commented on occurred with respect to the field capacity of the wastes having to be exceeded before leachate is generated.

On page 53 and for the next couple of pages is a discussion which represents further attempts to try to justify the modeling of the contaminating lifespan. Because of the relatively little difference between the projected contaminating lifespan using optimistic degradation rates for leachate constituents which ordinarily do not degrade in a landfill environment and the projected service life of various components for leachate management, there is legitimate concern about the reliability of the approaches used to estimate the contaminating lifespan. These estimates could be in sufficient error so that the contaminating lifespan for key components is greater than the service life of the leachate removal system proposed.

On page 4 of the "Response to G. F. Lee - Memo dated 22 November 1995," where Dr. Lee raised the question about birds possibly transmitting disease to humans or animals in the area, Notre responded that there is no evidence to suggest that this will occur. The statement by SENES that there are no known diseases carried to humans or animals by

gulls from landfills is a superficial discussion of issues. It would be difficult to be able to detect such diseases because of the lack of sensitivity of epidemiological techniques. There can be no legitimate question that the municipal solid wastes that are exposed in the landfill will contain infectious organisms to both humans and animals. Further, there is no question that birds feeding in the garbage can pick up disease organisms and transport them considerable distances. While, as discussed in Dr. Lee's previous comments on these issues, ordinarily this is not of concern because the solid wastes are derived from the area where the landfill is located, in the Kirkland Lake setting the transport of garbage from the Greater Toronto Area could introduce infectious agents to the landfill area that are not there now or are there only in minimal concentrations. The key issue, as Dr. Lee has discussed previously, is the need for a proper monitoring program to evaluate whether this is actually occurring, once the landfill becomes operational. To wait until people or animals die because of the transmission of disease organisms in the garbage that are not in the area in large concentrations at this time is inappropriate. The operator of the landfill should be required to conduct a monitoring program to ensure that public health and environmental safety is achieved.

As Appendix 1 Notre has included a Proposed Structure and Mandate for an Adams Mine Community Liaison Committee. No mention is made in this appendix of funding for third-party, independent monitoring and review of operations and post-closure activities. As Dr. Lee has discussed in his comments to the PLC, such funding is essential to ensuring that the landfill, if developed, is properly monitored for potential adverse impacts.

Notre has included Attachment A1H "Summary of Issues Raised by the Public in 1996 Review of Letters and Written Comments." A review of the materials presented in this section shows that many of the "Notre Responses" refer to the 1996 Environmental Assessment documents. A review of these documents, however, shows that a number of the references to them as provided in Table A1H are unreliable. Notre should be required to provide specific page and paragraph citations where the issues raised by the public are addressed in the Environmental Assessment documents.

CREDENTIALS

Dr. G. Fred Lee

Dr. Lee has been involved in landfill groundwater quality issues since the mid-1960's. For a 30 year period, until 1989, he held university graduate level environmental engineering teaching and research positions at several major U.S. universities. During that time he conducted over $5 million in research and published over 500 professional papers and reports on this research. One of the topic areas of his research beginning in the 1970's was the performance of landfill liner systems. He has published extensively on this topic. Further, throughout his over 35 year professional career he has served as an advisor to numerous governmental agencies, industry and others on water supply quality, water and wastewater treatment, water pollution control for surface and groundwaters, and the management of solid hazardous wastes. His advisory work included serving as an

advisor to public groups in Ontario, Saint John, New Brunswick and the City of Winnipeg on landfill siting and development issues.

Since he retired from university teaching and research in 1989 and became a full time consultant he has been active with many governmental agencies such as water utilities and municipalities and others in helping to evaluate the potential for an existing or proposed landfill to cause pollution of groundwaters. A full CV is included in Volume 2.

Brian Gallaugher

Brian Gallaugher is a graduate in urban planning from the University of Waterloo in Ontario. He also holds a Bachelor's degree from the University of Toronto. He has worked with waste management firms, government agencies and citizens' groups on all facets of landfill siting and solid waste management systems. His practice also involves urban planning work, issue resolution and facilitation. He is located in Toronto, Ontario.

If more information is required please contact the individual concerned.

Resolution of Conflict Among Experts

One of the issues associated with the development of landfills is a conflict between technical experts on groundwater pollution issues. Frequently, non-expert public groups involved in landfill issues are faced with the need to determine which expert's presentation of information is most reliable.

This is an issue that has been of concern to Dr. Lee for a number of years. Recently, the American Society of Civil Engineers, Civil Engineering, has published a review of this issue developed by Lee and Jones-Lee entitled, "Environmental Ethics: The Whole Truth," Civil Engineering, Forum, 65:6 (1995). This article is based on a report that they developed entitled, "Practical Environmental Ethics: Is There an Obligation to Tell the Whole Truth?" Both of these publications will be provided interested parties upon request to the author.

In their discussions of these issues, they have recommended that should a situation develop where disputes occur between experts in a topic area, then the dispute should be resolved by a panel of experts. This panel would require that each of the opposing experts presents the technical basis for their position on an issue in a full peer-review arena where all information in support of an expert's opinion is available for the panel and public review. The panel of experts would then recommend to the public body, responsible for formulating a decision on an issue, the appropriateness of each of the opposing expert's positions on the issue in dispute.

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(ENVIRONMENTAL ASSESSMENT SUBMITTED BY NOTRE DEVELOPMENT CORPORATION TO THE ONTARIO MINISTRY OF THE ENVIRONMENT AND ENERGY IN DECEMBER 1996.)

VOLUME 2 of 3 - Supplementary Reference Material

February 28, 1997

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REVIEW OF ADAMS MINE

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VOLUME 3 of 3 - Copy of 1995 Submission to

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Reference as:"Gallaugher, B. and Lee, G.F., 'Review of Adams Mine Environmental Assessment,' Volume 1 of 3 - Main Report, Prepared for Algonquin Nation Secretariat, Notre-Dame-du-Nord, Quebec, Canada, February (1997)"